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"VALLONS DE GELIVATION" IN CENTRAL LABRADOR-UNGAVA: A REAPPRAISAL*

J. T. ANDREWS

Geographical Branch, Ottawa

CENTRAL LABRADOR-UNGAVA occupies a critical position to those interested in periglacial processes, for the area is the contact zone between the periglacial and boreal morphoclimatic regions. The precise area under discussion lies close to the southern boundary of the periglacial morphoclimatic region delimited by Peltier,[1] a region that by definition experiences maximum mass-movement and wasting. The average annual temperature and precipitation at the Schefferville town-site is –4.9°C. (23.2°F.) and 53 cm. (20.9 in.) respectively, with a mean summer temperature (June-September) of 9.5°C. (49.1°F.). It is, therefore, not surprising that a number of writers have discussed various periglacial forms and processes occurring within the area. Henderson,[2] Derrau,[3] Twidale,[4,5,6] and Derbyshire[7,8] all have stressed the present-day potency of frost shattering, and have concluded that mechanical weathering in this region is an extremely active process. Henderson and Twidale, after studying forms which they attributed to combined frost action and solifluction demanded a reduction in the average annual temperature during part of the post-glacial period. Henderson[9] in 1956 had described a series of forms which he called "nivation hollows," while Twidale[10] in the same year described a system of alcove-like valleys in a ridge near Schefferville, and concluded that they were the products of periglacial action. The valleys were termed "vallons de gélivation." The ideas embodied in Twidale's text have attracted much attention, not only within Canada, but on an international level. This was in part accomplished by a review of Twidale's articles in the *Periglacial Bulletin* by Dorywalski,[11] who accepted the main conclusions and attempted a very tentative genetic classification between these features in central Labrador-Ungava and elsewhere, notably Greenland.

It is thus gaining acceptance, both at home and overseas, that central Labrador-Ungava is experiencing and has experienced extreme periglacial weathering and mass-movement, which has led to the creation of secondary landforms. It is extremely unfortunate that these ideas have been based on misinterpreted field data. This paper is presented as a plea for the greater understanding of the freeze-thaw process, a process that is often invoked as a potent weathering agent, yet one in which the actual mechanism is little understood. Strict quantitative research is needed to solve this problem.

LOCATION AND STRUCTURE

Dolly Ridge is situated three miles east of the Schefferville town-site, the iron-ore mining town of central Labrador-Ungava. The town lies some 360 miles north of Seven Islands on the north shore of the St. Lawrence.

In the vicinity of the town-site the Proterozoic rocks of the Labrador trough strike north-northwest to south-southeast, and the varying lithologies of the trough rocks have resulted in differential erosion fashioning a landscape of vales and ridges. Dolly Ridge is one such ridge (Figure 1). The ridge is composed of argillites dipping east-northeast between 35°-40°; east and west of the ridge fissile shales outcrop on the valley floor (Figure 2). The relief on the west side of the ridge is approximatey 90 m. (295 ft.), but east of the ridge crest there is a shallow vale, 7 m. (23 ft.) deep which leads onto a higher escarpment formed of quartzites.

Incised into the west face of Dolly Ridge are a number of valleys. These were examined by Twidale and a map was produced,[12] which indicated that twelve

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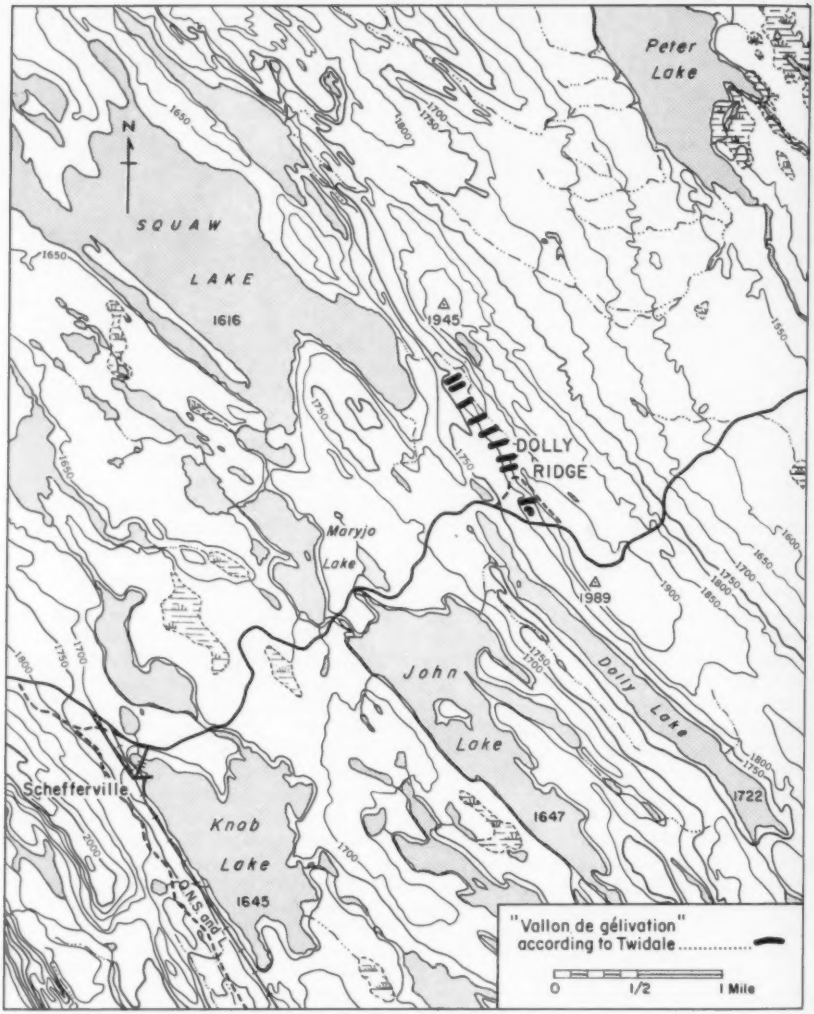

FIGURE 1: Location of Dolly Ridge and main topographic features in the vicinity of Schefferville.

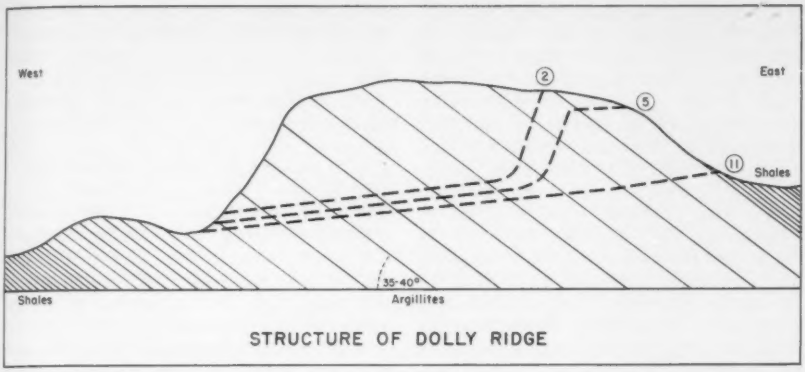

FIGURE 2: Generalized cross-section through Dolly Ridge to illustrate the importance of lithology in the Labrador trough. Numbers 2, 5 and 11 refer to individual "vallons" and the dotted lines indicate the morphology of these features (*see* Figure 4).

distinct valleys had been recognized in the 1¾ miles from the Schefferville–Dolly Ridge road to the north end of Squaw Lake (see Figure 1).

ORIGINAL DESCRIPTION OF THE VALLEYS

The valleys were described in the following terms: they have a vertical backwall, and a modified V-shaped cross profile; their long profile is irregular due to the outcropping of resistant rock strata. The largest valley has a length of 90 m. (295 ft.) and a width and depth of approximately 8 m. (26 ft.). The valleys were thus described as possessing an alcove-like morphology (Figure 3). At the outlet of the valleys are accumulations of pro-talus moraine, 90 cm. (35.4 in.) high.

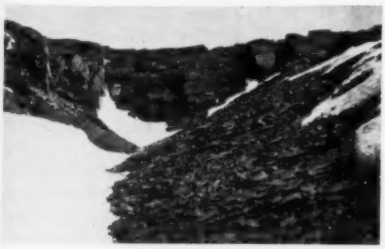

FIGURE 3: A classical "vallon de gélivation" as described by Twidale. Note the vertical backwall, and the screes in the foreground. This is valley 2 (*see* Figures 2 and 3). (*By W. Mattox.*)

The valleys were compared with the "ravins de gélifaction" described by Boyé[13] from Greenland, and a similar origin was ascribed to the formation of the valleys in central Labrador-Ungava. It was suggested by Twidale that the valleys were the product of repeated freeze-thaw cycles, leading to the disintegration of the bedrock along major joint lines aligned at right angles to the strike of the argillites. Expansion of the valleys into the ridge was primarily caused by the freezing of meltwater trickling down the rock-snow interface in spring. The resultant frost-riven material was removed by solifluction. Quantitative studies in the valleys[14] indicated little movement during the year of observations, and it was, therefore, concluded that only certain years were favourable at the present time for the operation of the periglacial processes. It was postulated that the valleys were post-glacial in age and were periglacial phenomena.

1959–1960 FIELD WORK

During the course of a year spent at the McGill Sub-Arctic Research Laboratory at Schefferville the author was impressed by the paucity of frost-shattered material, and by the weight of evidence favouring a conclusion that periglacial activity in the area had been overstated.

On the crest of Dolly Ridge and immediately adjacent to the "vallons de gélivation" are beautifully preserved glacial striations, which suggest that, if the "vallons" are periglacial in origin, then there is a significant anomaly in the effectiveness of the processes within a few feet. To test the validity of the "vallon" hypothesis a series of temperature measurements were taken during the spring of 1960 to facilitate the comparison of the range, and possibly the speed of temperature fluctuations at ground level and at the rock-snow interface. Temperatures were measured with standard Department of Transport thermometers, and a minimum and maximum thermometer which was lowered into the space between the backwall and the snowbed. Observations were conducted every second day. The results were conclusive: on no occasion within the rock-snow interface did the thermometer register temperatures of over ±1°C. (33.8° to 30.2°F.) above and below the freezing point, even though the outside temperatures ranged from extremes of 18°C. (64.4°F.) to —10°C. (14°F.). Grawe,[15] Reiche,[16] and Battle[17] all concluded that the potency of frost-shattering has been overemphasized and oversimplified, and their consensus of opinion is that both the range and the speed of the temperature change is important. In the case of frost action on a rock wall which is covered by a snowbed, it is obvious that the range of temperature fluctuations will be small and the speed of the fluctuations will be slow. Taber,[18] however, emphasized the importance of pore size in conditioning the effectiveness of frost action, and stressed that extreme temperatures are not necessary if the rock is fine-grained, permeable, and fully saturated. In the case of the well-bedded and jointed argillite series, the frost shattering is controlled by the freezing and thawing of water in joints and crevices, and the establishment of a closed system, which is related to the range and speed of temperature fluctuations. Though there is moderate development of scree slopes[19] within the valleys and in other parts of the Labrador trough, it is noticeable that in the majority of cases the screes are well lichened, which denotes considerable stability of the slopes.[20] Furthermore, the backwalls of the classical "vallons" are covered by well-developed crustaceous lichens, with little freshly weathered bedrock exposed.

It is suggested that mechanical weathering in a sub-arctic, or even arctic, climate is a very slow process, save on certain rock types, notably limestones, and under exceptionally favourable circumstances. Small-scale fluctuations of a few degrees about the freezing level cannot be considered as a suitable index of the effectiveness of frost shattering. This conclusion is still valid even if it is argued that the valleys were the product of a post-glacial cold cycle. The discovery of small pro-talus moraines, lying parallel to the ridges west of Schefferville, allow an estimate of 1.7° C. (35.1° F.) as the minimum reduction of the summer temperature (June-September) at that period when the pro-talus moraines suggest permanent, or semi-permanent, snowbeds lay against these ridges.[21] The summer of 1956 fulfilled these conditions. The summer was exceptionally cool, with an average temperature of 7.8° C. (46° F.), and snowbeds stayed throughout the summer.[22] The summers of 1954 and 1959 were also noted as years when snowbeds stayed throughout the summer, though apparently for other reasons than temperature control.[23] However, cooler summers imply a lessening in the range of temperature fluctuations, and Fraser[24] has also shown a southward increase in the number of freeze-thaw cycles in Canada; while Rapp[25] has suggested that the large-scale climatic cycles are by far the most important.

There is legitimate doubt that coarse scree material can be removed from a "vallon" by solifluction, for by its very definition solifluction is incapable of moving material of this grain size, unless it overlies, or incorporates finer particles of the sand-clay fraction. An alternative proposal for the removal of coarse material in a periglacial area would be by means of rock streams located within each valley. The descriptions of these forms by Capp[26] and Kesselli,[27] who both stress the wrinkled nature of the surface and the concave long profile, do not, however, coincide in any detail with the debris accumulation located

in front of the valleys; and it is suggested that this hypothesis is not valid under the circumstances.

A further incidental observation is that investigations by the 1959–1960 Laboratory staff[28] of the state of the ground under late-lying snowbeds indicate that the ground remains frozen until such a time as the snow disappears entirely. These findings, though necessarily subject to further research, suggest that the nivation process as described by Lewis[29] and Henderson[30] is open to questioning within the Schefferville area.

1959–1960 FIELD WORK: MORPHOLOGICAL INTERPRETATION

The small range of the temperature fluctuations, the difficulty in envisaging solifluction as an agent of scree removal, and the lack of evidence to suggest that rock streams were responsible for the removal of the frost-shattered debris from the valleys, all indicate that the freeze-thaw hypothesis of the valleys is unsound. This conclusion led to a programme of plane-table mapping in which the individual valleys were systematically mapped. The results showed quite clearly that the post-glacial and periglacial theory of the origin of the valleys is incapable of explaining most of the valley forms and an alternative explanation, therefore, is required.

A superficial examination of the valleys in the summer of 1960 revealed a striking diversity of valley form, though the original description only emphasized the alcove-like morphology, and variations on this form were not commented on.[31] The actual valley morphology can be seen in Figure 4. It is apparent that only six out of the twelve valleys correspond to the alcove-type, but even then there are important variations upon this initial form. Five of the valleys, numbers 7, 8, 9, 11, and 12, completely breach the escarpment crest and open out towards the shale vale (Figures 5 and 6).

It is apparent from Figure 4 that the majority of the valleys possess a linear

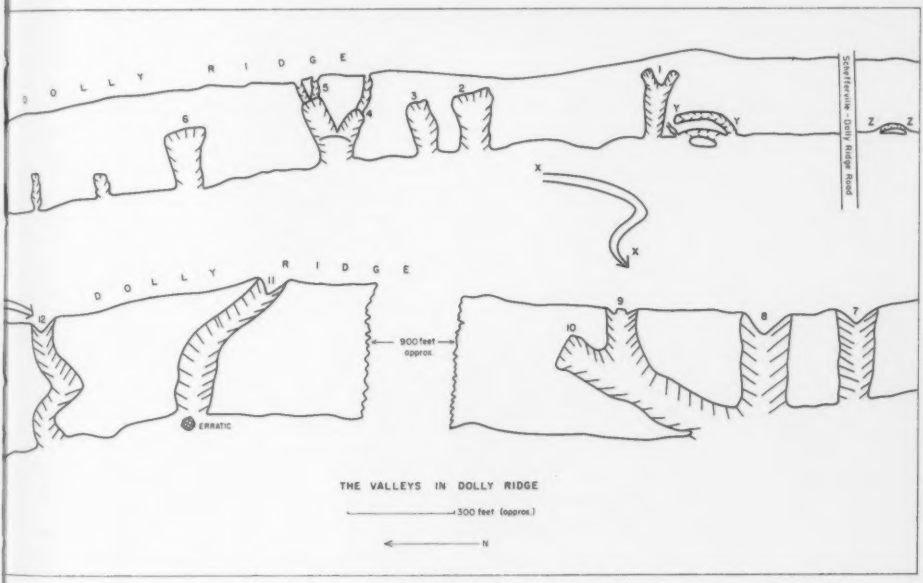

FIGURE 4: A sketch of the varying morphology of the valleys incised into Dolly Ridge.

FIGURE 5: Valley 7. Completely breached through Dolly Ridge, and opening out to the vale beyond.

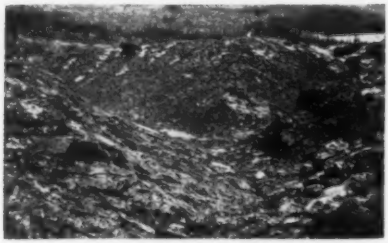

FIGURE 6: Looking down valley 9 from the breach in the escarpment. Valley 10 can be seen on the right, where it becomes confluent with 9. (*By P. J. Williams.*)

form, related to major joint lines, but this description does not apply in all cases, for valleys 9, 10, 11, and 12 are curved and transcordant to structure (Figure 7). Valley 12 is the most extreme case in point, possessing in its lower section a distinct meander-like curve (Figure 8). When the sequence of morphological changes is considered, then there is an obvious northward

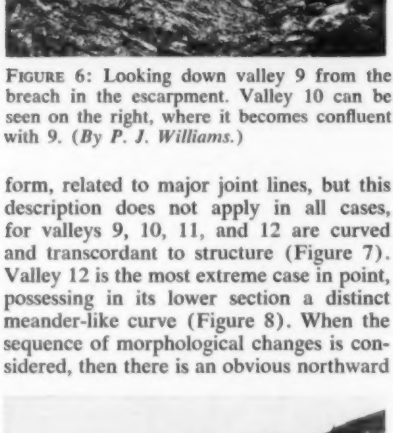

FIGURE 7: Valley 2 as seen from near its intake. The valley curves sharply to the left and runs transcordant with the structure. (*By P. J. Williams.*)

FIGURE 8: A view taken down valley 12 illustrating the very sharp meander-like curve that the valley takes near its outlet. (*By P. J. Williams.*)

increase both in the magnitude of the escarpment breach and in the disregard of structural control.

At least a partial answer to the question of what process or processes actually produced these small valley forms is possible if related forms are examined and explained. At Y-Y and Z-Z (Figure 4) are three glacial drainage channels of the in-and-out variety, which give an adequate testimony of the efficiency of glacial meltwater as an agent of erosion. In fact, there is a strong possibility that valley 1 is continuous with the upper in-and-out channel at Y-Y, though talus makes a correct appraisal difficult. Further north and also west of valleys 1 and 2 a very distinct channel slopes parallel with Dolly Ridge, until it turns at right angles through a secondary ridge, and then turns south again along the main valley floor. The valley has steep sides, is flat-bottomed, and resembles descriptions of sub-glacial drainage channels by Ives[32] and Derbyshire[33] from the Schefferville area. It is considered that the channel X-X on Dolly Ridge had a similar origin. The association of "vallon" and glacial drainage channel occurs once again at valley 12, where a glacial drainage channel sloping south leads directly to the head of the valley, which appears but a continuation of the sub-glacial drainage system aligned at right angles to the contours.

No evidence was found to support the statement that pro-talus moraines are located in the front of each of the valleys. Instead, there is an apron of coarse rock debris, mainly local in composition but

with erratics included. In an exposure 10.2 cm. (4 in.) of local material overlaid a coarse glacial till. When mapped, the deposits have a slight southward displacement at the mouth of each valley.

A final and conclusive indication that the valley was not periglacial in origin was the discovery of a massive block of Wishart quartzite (Figure 4) located at the outlet of valley 11. The slopes on either side were negligible, and the boulder must, therefore, postdate the formation of the valleys and the only method of emplacement is by deposition from a former ice-cover after the valleys had been cut to their present form.

It is evident in the present landscape that, since the deglacierization of the Schefferville area some 7,000 years ago, the slow process of frost-shattering has been operative. Figures 3, 5 and 6 all show scree formations in the valleys, but the seemingly large quantities of frost-shattered material is only a superficial impression, the scree cover is thin, and the screes are in a retarded state of development.[34] However, the evidence for periglacial action cannot be ignored, but the point of controversy is the actual amount of periglacial weathering and modification that has been accomplished since post-glacial times. The answer is that the effect on the landscape has been very limited. The present climate is slowly widening joint lines and is forming incipient valleys in Dolly Ridge. It is suggested that this process initially conditioned the location of each valley, and that the valleys were in existence in pre-glacial times, though not at their present state of development. This conclusion is borne out by the deficiency in volume of loose local material in front of each valley as compared with the actual volume of the valleys. The incipient valleys are today choked with debris, and, though the effect of the last glaciation is in detail unknown, it probably cleared away the accumulated rock debris. The evidence indicates, however, that the valleys were modfied to their present size and morphology during the final stages of the deglacierization of this area. Ives and Derbyshire showed that the movement of the glacial meltwater in the area was to the south, and Ives concluded that the glacial drainage channels were subglacial in origin. The ice in the final phases was stagnant with possibly some movement in discrete areas. In considering the variations in valley morphology on Dolly Ridge there are three important points: (*a*) the association of the valleys with sub-glacial drainage channels, (*b*) the southward increase in the degree of structural control, and (*c*) the southward decrease in the extent of the escarpment breach. These factors lead to the conclusion that the "vallons de gélivation" are but a variety of sub-glacial channel. If the existing nomenclature for glacial drainage channels is considered, then the name "structurally controlled chutes" is offered for consideration, as the term is descriptive and yet at the same time delimits the mode of origin.

The sub-glacial channel X-X (Figure 4) is proof that meltwater was penetrating beneath the ice during deglacierization, and was always attempting to flow from the higher to lower levels; the topography and ice conditions were controlling factors in this process. The glacial channel which leads directly into valley 12 illustrates this process: meltwaters flowed south in subglacial channels, utilizing pre-existing depressions where possible; the main flow was directed south along the shallow vale behind Dolly Ridge, but as the water moved south it was led off via a series of sub-glacial chutes aligned at right angles to the main flow. The incipient valleys were thus utilized and modified by the meltwaters. This process continued along the length of Dolly Ridge up to valley 1, for though not very pronounced, valleys 1, 2, 3, and 4 have shallow channels leading to their vertical backwalls. The degree of escarpment breaching is, therefore, a natural outcome in the progressive reduction of meltwater volume and velocity from north to south, as water was led away through the structurally controlled chutes. The fans of local rock spread out in front of the valleys testifies to the considerable erosive power of meltwater under these conditions. The validity of this hypothesis is strengthened by the similarity of a subglacial drainage system described by Derbyshire[35] near Ruth Lake, three miles north of Schefferville. Similar forms are again found at Silver Yards, two miles west of Schefferville.

CONCLUSIONS

The alternative theory of the origin of the valleys incised into the west face of Dolly Ridge stresses the complexity of their forms, and also their origin. It is suggested that they are at least earlier than the last glacial in age, and owe their initial location to the widening of joint lines by frost action. They were later modified by meltwater action during the deglacierization of the Schefferville area.

The suggested periglacial origin of the valleys, and its ready acceptance, is indicative of a present tendency by some geomorphologists to overstate the role of the periglacial processes in the creation of Canadian and other landscapes. Dorywalski[36] accepted the periglacial origin of the valleys, and following Twidale compared them to forms in Greenland, though the present writer sees little visual resemblance. Recently Biays[37] described a "vallon de gélivation" from the Labrador coast, which again had little resemblance to the forms in central Labrador-Ungava.

The stabilization of the scree slopes in the Schefferville area is extremely interesting in view of the severe climate, and serves as an indication that periglacial action is limited. Oversteepened slopes have scree accumulations and the original profile of the structural chutes have been modified; nevertheless, it is apparent that the amount of periglacial activity in central Labrador-Ungava has been vastly overestimated. Peltier's morphoclimatic limits need to be re-examined, and the efficiency of the periglacial processes need reconsideration. As a case in point, investigations of soil movement on the east slopes of Dolly Ridge gave negative results,[38] even though the vegetation suggested a considerable down-slope movement. Later investigations[39] suggested that snow creep was the main factor in the deformation of the vegetation, which superficially would have been attributed to soil creep and solifluction.

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RÉSUMÉ

Twidale a décrit un système de vallées en forme d'alcôves situées le long de l'escarpement occidental du Dolly Ridge, à trois milles à l'Est de Schefferville, dans la Labrador central. Selon lui, ces vallées résulteraient d'un élargissement de certaines lignes structurales de moindre résistance, à la suite de gels et dégels successifs de l'eau emmagasinée dans les joints et les crevasses. Les matériaux ainsi libérés auraient été évacués par solifluction. Ces vallées furent appelées « vallons de gélivation ».

On en fit de nouveau l'examen au cours du printemps et au début de l'été 1960. On mesura avec précision l'ampleur des fluctuations de température le long de la ligne de démarcation entre le roc et la neige, dans le but de mettre l'hypothèse énoncée plus haut à l'épreuve, et on fit le relevé à la planchette de toute cette série de vallées, de façon à pouvoir comparer plus facilement leurs formes.

Ces vallées résultent essentiellement de l'action des eaux de fonte sous la masse de glace aux derniers stages de la présence de cette dernière dans la région de Schefferville.

A l'appui de cette thèse, l'auteur décrit d'autres formes de relief similaires observées dans la même région. En plus de cet argument morphologique qu'il oppose à l'hypothèse de Twidale, il met en doute la validité des procédés de genèse par lesquels ce dernier explique la formation de ces vallées, et il affirme qu'on a tendance à exagérer l'importance du rôle de l'érosion mécanique dans le Labrador central.

CONURBATION CANADA

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AT THE TURN of the century the biologist, Patrick Geddes, who became the "father" of contemporary town and regional planning in Britain, coined the word "conurbation." He used this term to describe the way in which the industrial cities of Western Europe, particularly in areas such as the Rhine Valley, the English Midlands, or the plains of Northern Italy, tended to grow into each other, thus becoming completely new urban phenomena. Geddes was aware also of the same trend in North America and foresaw the incipient conurbations of the Atlantic Seaboard and Great Lakes regions. Fifty years later planners are still groping towards a clear understanding of the phenomenom, for there have been few studies of conurbations as such. In addition they still are seeking ways to put into effect the regionalism which Geddes, his successor Mumford, and such great geographers as Fawcett, Demangeon, Dickinson, and Aurousseau have described and advocated.

Canada has now become a predominantly urban nation with almost one-fifth of its total population concentrated in two large urban areas—Montreal and Toronto. To the town planner, the Toronto urban agglommeration is the more fascinating because, while it is fitting to identify the urban region around Montreal by the name of its core city, it is no longer possible to call the urban sprawl around the western end of Lake Ontario "Toronto." Even with the relatively new political unit of Metropolitan Toronto, the familiar bursting of administrative and political bounds of all major conurbations is found in the way in which the cities of Toronto, Hamilton, Niagara Falls, Oshawa, Oakville, Burlington, St. Catharines, and Welland—and possibly, in addition, the complex of Kitchener, Waterloo, Galt, Hespeler, Guelph —increasingly reach towards each other without regard to familiar identity or historic institutions. This is the undefined and unexamined city of the year 2000 called "Mississauga" by Professor D. F. Putnam (Figure 1).[1] It has also been called "Conurbation Canada," for it will probably have a population of 5,000,000 before the end of the century, and will certainly render our present-day terms and definitions of urban development obsolete.[2]

Traditional views, familiar concepts, and institutions inherited from the agricultural society of a few decades ago may well prevent the recognition of this great new city, which, unless it is guided and treated as a unit will certainly sprawl wastefully and uneconomically in all directions. The force of conurbations has been consistently underestimated. The great cities of the world invariably have broken through their artificial restrictions; Moscow may yet pass the target population set for it by a bold plan despite increased density controls;[3] London continues to expand in spite of the recommendations of Abercrombie;[4] and most larger North American cities have greatly exceeded the population and area projections made after the 1939–1945 war. Thus, if there is a lesson for planners in the growth trends of great cities and their appearance as conurbations, it is that, even with a magnificent plan and the finest legislation, the maintenance of good living and working conditions and sound recreational areas is at best difficult. What dire predictions might then be made for an area which develops according to no plan?

There are many studies for individual parts of the Mississauga area or aspects of the conurbation problem. The Provincial Department of Municipal Affairs, for example, has under way a study of the land use and economic base of the area; but to date it is extremely difficult for the concerned planner to see what is happening except by assiduous reading and cross-references in personal experience, or by constant trips throughout the area. But the "windshield" survey method is notoriously unreliable.

There is already a serious deficiency in the available parkland and recreational facilities that can only be offset by viewing

the problem as a whole and planning for the ultimate population rather than the local one. This is only one example of the problem. But if there are such difficulties in a key field such as recreation, what will an over-all view reveal in other aspects which have not been studied regionally? There are no studies of regional welfare, mental health and hospital facilities, housing policy, educational facilities, or atmo-

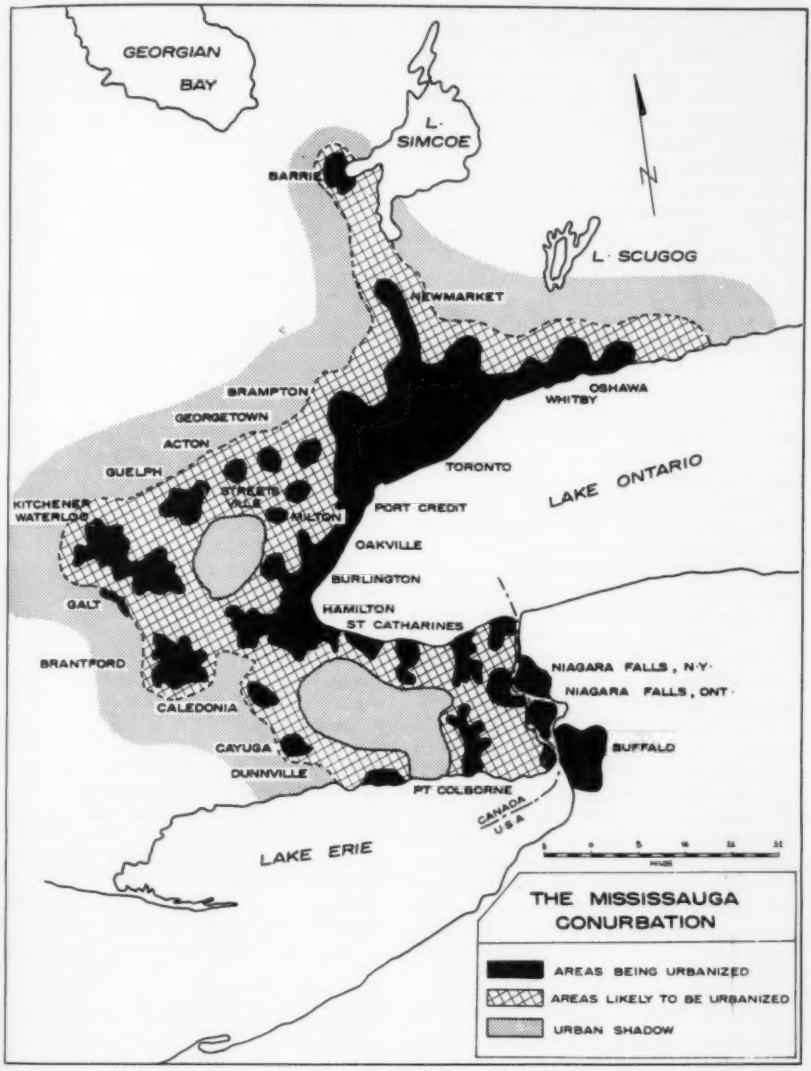

FIGURE 1

spheric pollution. Expert geographical analysis and an interpretation by planners is urgently needed.

A GLOOMY PROPHECY

Under these conditions, my prophecies are gloomy. This conurbation, if present trends continue, will sprawl northwards to Lake Simcoe. The tendencies are already there. What has been called "exurbia" in New York has begun to appear already—the "suburbia of suburbia" is skipping outside the new municipality of Metropolitan Toronto.[5] Similarly, so-called "new towns" are appearing to the west of the city. The conurbation will very rapidly link the lakeshore settlements into a linear city that will make the dreams of the proponent of *La Cuidad Lineal* seem tiny. Sr. Soria y Mata saw his linear city as a rational and efficient concept along the lines of the "garden city" of nineteenth-century prophets and town builders like Ebenezer Howard.[6] The specimen he created outside Madrid, or the one which was created in the building of Stalingrad, had a definite schematic basis and developed in accordance with it. Mississauga is a long way from any such scheme.

Canada cannot avoid bigness or vast urbanization on the scale foreseen by the Gordon Commission Report;[7] what is appalling to the planner is not that this new city will be so huge, but rather that it is not being planned *as a unit* for the good of the present or future inhabitants. The real problem of the conurbation is not to prevent it, for that is well nigh impossible and may not even be desirable. The problem is, rather, how to guide and control the form of the conurbation so that it has a rational structure and achieves a socially desirable form. If we do not do this, Canadian planners will have failed their greatest challenge. The necessity of an over-all concept has been proven in all major conurbations. The major ones of the world are actively guiding their destiny. The Mississauga conurbation is the one significant exception.

THE SCALE OF THE PROBLEM

Statistics suggest that the Mississauga conurbation has all the characteristics of a major national problem. It is clear from available research that the nation as a whole probably will achieve the estimates of the Royal Commission on Canada's Economic Prospects. Their forecast saw a national population approaching 26,650,000 by 1980, with almost 80 per cent of it urbanized. Of that urban population, it was estimated that 12,000,000 would be in the 15 major Metropolitan areas (45 per cent of the total population). Of all national areas, Ontario has had the greatest share and will continue to contain the major urban population in its various centres. At that time Ontario will have about 8,500,000 of a total Canadian population of 27,000,000. Thus, one-third of all Canadians will live in Ontario, and of these about two-thirds will live in Mississauga. In the absence of any provincial study of the impact of these trends on the Mississauga area, reliance must be placed on various area studies and special research projects undertaken by the universities or by the local planning agencies for a reasonable picture of the significance of this scale of urbanization.

The major component of Mississauga is, of course, Metropolitan Toronto. The draft Official Plan of the Metropolitan Toronto Planning Area shows an estimated 1980 population of 2,800,000 (1959 projection). The other major nucleus is Hamilton, and the 1980 population of the metropolitan area was forecast in the Urban Renewal Study of 1958 as 506,000. It will be noted that the area of extremely rapid growth here is Burlington, which forecasts 144,000 by 1980 (in the latest 1961 revision of the Official Plan based on a study by Professor G. Potvin of the University of Toronto). Between lies the Oakville-Trafalgar urban area. The 1961 forecast for this area is a 1980 population of approximately 160,000.[8] The 1980 population forecasts for Niagara Falls and St. Catharines are approximately 92,000 and 175,000 respectively.[9] Brantford will probably have 75,000 by then, and the Kitchener-Waterloo area about 165,000.[10]

Thus, for 1980 population forecasts are:

Metropolitan Toronto	2,800,000
Metropolitan Hamilton	506,000
Oakville-Trafalgar	160,000
Kitchener-Waterloo	165,000
Brantford	75,000

St. Catharines	175,000
Niagara Falls	92,000
Oshawa	130,000
Mississauga Conurbation	4,103,000

If the official projections for 1976 by county for the areas affected are taken, the results, according to the Economic Survey of Ontario,[11] are as follows:

Metropolitan region (including Halton, Peel, Ontario, York)	3,089,000
Niagara region (including remainder of Halton and Brant; Wentworth, Haldimand, Lincoln, and Welland)	1,167,000
Waterloo County	269,000
Wellington County	111,000
Mississauga Conurbation	4,636,000

As this is the estimate for 1976, it can be safely assumed that by 1980 the population of the conurbation will approach 5,000,000. As the same source indicates that the 1956 population of the same area was about 2,607,000, the twenty-year increase to 1976 is about 2,029,000, or the physical equivalent of building another Toronto and another Hamilton!

HOW MUCH LAND?

A sure result of a population of 5,000,000 in this conurbation by 1980 will be intense land-use conflicts. At the prevalent rate of urbanization, new residential land requirements alone will total about 35,000 acres or 210 square miles for the whole conurbation. This does not include the other extensive uses which can be expected in a major conurbation—major highways at 10 acres per mile, interchanges at 30 acres for each, transport and trucking terminals at 50 acres each, major industrial estates of 200 acres each, universities at 300 acres each, hospitals at 50 acres each, and district shopping centres, oil refineries, and so on.

The magnitude of the problem in only one facet of the conurbation has been demonstrated by Professor Krueger in his recent work on the Niagara fruit belt.[12] He has shown that, in the critical area of the tender fruit soils lying along the shoreline of Lake Ontario in the general vicinity of the Niagara Escarpment, particular soil resource is restricted to a potential of about 35,000 acres, of which 36 per cent has already been lost to urbanization. The bulk of that loss was in the past two decades. On the remaining fruit belt, careful planning can easily accommodate another 1,000,000 people—allowing for expansion of Hamilton, St. Catharines, and Niagara Falls as already indicated—while still leaving a hard core of 26,000 acres of the potential fruitlands. Given care, the fruit-growing areas can survive alongside the urban and industrial growth; the same can be said of the wine and grape industries of that area. From research by Krueger, Hostetter, and Sinclair (in independent work)[13] it is clear that, given control of sprawl, there is no need to fear for the future of grape-growing in the Niagara Peninsula: as the fruit-growing pushes the grapes off the tender fruit soils, the graperies can move to another 36,000 acres of suitable soils—but if these alternative lands are spoiled by premature low-density urban sprawl such an adjustment might easily be prejudiced.

Most planners accept a standard of 10 acres per 1,000 for reasonable recreational facilities. Applied to the Mississauga area this means that within Mississauga 2,100 acres of parkland for various purposes should be set aside now, before land values make their retention impossible or their purchase impracticable. If there is too long a delay the desirable sites will be exploited or built over in the absence of a regional plan. This is only part of the need, for other sites will be needed on the periphery of Mississauga. It is clear that in the next decade it will be increasingly difficult to acquire large land holdings at sensible places with the chance of reasonable prices. Already, large corporations have assembled very extensive holdings for settlements of, say, 100,000 people in the area immediately west of Metropolitan Toronto, and this trend will intensify as time passes.

Taking into account all uses typical of metropolitan sprawl, Canadians have in the last two decades become extravagant land-users. The average density of urbanization, taking into account *all* land uses,

is 5,000 persons per square mile. This is to imply that, if present concepts of city-building are not changed, the *total* impact of all the extra people to be accommodated in Mississauga in the next twenty years will demand the urbanization of 405 square miles, or about double the present area.

THE URBAN SHADOW

A most serious menace to Mississauga is the extent to which the future of apparently open land is already decided by speculators, by investment groups, and by the steady increases in land values following in the path of the new highways. The actual physical sprawl of the cities in Mississauga is apparent in three dimensions and can be visually appreciated. The surge of bricks-and-mortar has led to ready definition of the future city, even in the areas which are still predominantly cow-pastures. But the indirect effects of the sprawl are much more severe. Because the controls over the form and structure of Mississauga are rudimentary, the "urban shadow" is greatly extended over areas far beyond what seems rational or essential. Studies prepared for the Conservation Council indicate that the full extent of "urban shadow," seen in terms of speculative activity, non-farm uses, non-rural assessment, absentee ownership, and actual dereliction of land, is only barely appreciated.[14] It seems to vary from about twice the present urbanized area to four or five times that area. The first symptoms indicate a great need for immediate, intensive research on the extent and significance of the urban shadow on a national scale. In the meantime it is clear that the effect is greater in the larger cities; thus the problem of this waste of both land and resources can only get worse in Mississauga.

CONURBATION PROBLEMS

To summarize, the problems of the conurbation are as follows:

(*a*) unplanned sprawl and extensive urban shadow;
(*b*) uneconomic city building and waste of land resources;
(*c*) unnecessarily extensive commuting and over-reliance on automobiles;
(*d*) danger of present shortage of parkland becoming seriously worse;
(*e*) actual over-all trends to deterioration of regional environment;
(*f*) consequent worsening of social conditions manifested in statistics of mental health, alienation, delinquency;
(*g*) inadequate framework of local government and no recognition of over-all needs and priorities;
(*h*) no control over industrial location;
(*i*) steadily increasing air pollution problem demanding regional treatment;
(*j*) general lack of planning objectives;
(*k*) lack of basic analytical data.

These are problems which transcend the conventional framework of reference. The giant conurbation is a new phenomenon in Canada. But that is not to imply the process ends with the Mississauga defined here. Rather, the giant conurbation, as the extension of cities released from the confines of the railway age, may be expected to become the rule. Eventually even greater conurbations must be expected; thus the challenge is to maintain the human scale, to demonstrate some evidence of *form* in the resulting cultural landscape. It may be that the image of the conurbation should now be that of the *constellation*: a multi-nuclear city, with dominant focal points, a host of subsidiary nuclei, and a widespread surrounding area of lower density urbanization.

CHARACTERISTICS OF THE CONSTELLATION

The following points are the baldest summary of what should be possible in actively guiding a conurbation into a constellation pattern (Figure 2):

(*a*) firmly established central functions in a high-density core area readily accessible to all parts of the conurbation;
(*b*) a rational structure of second-rank nuclei supplementing the cultural, government, and commercial characteristics of the main core;
(*c*) architectural development of these into centres with human scale and distinctive character;
(*d*) easy accessibility of work places and living places to each other, to give maximum choices of environment;
(*e*) a definite form to the physical development to give expression to the foregoing relationships;

(*f*) a well-knit and fully developed system of transportation giving the maximum range of choice of means of movement;
(*g*) easy access to open areas within the conurbation;
(*h*) easy access to the open countryside (preserved as such);
(*i*) stability of the basic structural form;
(*j*) provision for adaptation to change without deterioration of the form or the living conditions associated with it.

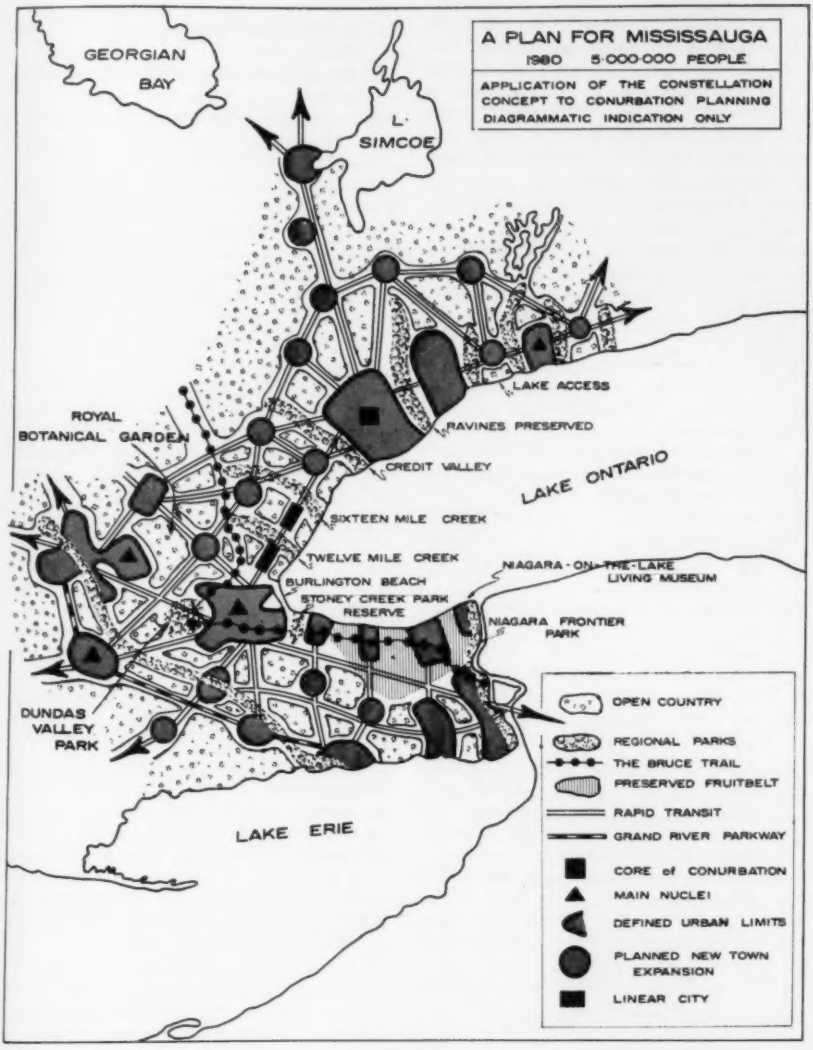

FIGURE 2

(*k*) local communities to have definite form expressed in an architectural idiom and landscape design.

Few, if any, of these objectives are being achieved at present.

ACTION NEEDED IN MISSISSAUGA

The first essential is that a basic survey of Mississauga be undertaken using the most modern inventory techniques. The object of this would be to establish what is actually happening to land use and to provide the necessary information for the preparation of a plan for the whole conurbation. It should be carried out either by the provincial departments concerned or by a university within the conurbation acting as a co-ordinating body. For optimum value from the work it would be necessary to organize it on a continuing basis, so that as time passes periodic analyses of the changes in the area can be drawn out of the work for immediate application in planning.

Such a survey of Mississauga would include analysis of the following:

(*a*) the existing land-use pattern and the changes which are occurring in it;
(*b*) the socio-economic characteristics of the conurbation;
(*c*) the demographic aspects of the conurbation with a study of the signficant census material over past decades;
(*d*) analysis of the water resources and the water needs;
(*e*) study of the pollution of air and water and the trends over the whole conurbation;
(*f*) the extent and significance of the urban shadow in Mississauga;
(*g*) transportation study covering the total transportation system (private cars, trucking, railroads, commuter rail traffic, bus systems, and alternative modes of rapid transit);
(*h*) housing needs at present and in the future;
(*i*) land-use needs for industry, commerce, cultural, and administrative pursuits over the next twenty years;
(*j*) study of the strengths and weaknesses of the economic base;
(*k*) basic data for producing employment policy and industrial location policy;
(*l*) study of land needs for recreation and public open space;
(*m*) examination of redevelopment and urban renewal needs on conurbation basis.

All this research work will take considerable time. There is thus an additional need for:

(1) a rapid reconnaissance of the Mississauga area;
(2) preparation of an advisory outline plan.

At the present, effective regional planning does not exist. Over the past few years it has become evident that the provincial agencies are not producing either a provincial plan of co-ordinated public policies or regional plans for priority areas. It has also become evident that even the most effective and powerful planning agency, the Metropolitan Toronto Planning Board, is unable to tackle the Mississauga problem. Furthermore, the joint area planning boards in the major focal points of the conurbation have all encountered severe political problems the moment they tried to do their job. The absence of regional planning leads to pitiful absurdities in local actions. This situation can only be remedied by action at the provincial level.

A PLAN IS NEEDED

The plan should be truly regional, and when prepared should be given statutory force so far as its regional provisions are concerned. It should show some such overall concept as the constellation scheme already advanced, and the principal proposals needed to effect that concept. The scheme might also pave the way for a reorganization of local government units on a more sensible basis and for a reorganization of planning areas. These reorganized units could then be given the task of filling in the detailed proposals (even to the design of neighbourhoods with attention to the resulting visual scene) as quickly as possible. But it is to be noted that the predominant land use, the definition of the urbanized area, the broad density pattern, and the main transportation and servicing patterns must conform

to the regional plan. It would seem sensible to aim at an average urban density about double that now being achieved—and the impact of such a decision on costs of urbanization will be significant. But it will not be effected unless there is regional control over sprawl and local conformity to the density ranges in an over-all plan. The relationships between land use and transport systems can be predicted and controlled, and such controls are basic to the regional plan, together with an employment and industrial location policy.

But all of these points resolve themselves into the determination on the part of the planning and allied professions to see that the phenomenon of Mississauga, and others like it, are clearly understood; and that once understood, it be guided in such a way that the metropolis with a distinctive form, worthy of that name, is fit for five million Canadians to live in.

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RÉSUMÉ

La croissance urbaine prend de plus en plus d'ampleur à travers le Canada. De toutes les régions affectées par ce phénomène, celle qui offre le plus d'intérêt et défie les normes les plus généreuses est sans doute ce groupement d'agglomérations occupant le secteur occidental du bassin du Lac Ontario et que le Professeur Putnam a appelé « Mississauga ». Cette région mérite bien le titre de « Conurbation Canada », puisqu'elle présente des problèmes très particuliers d'aménagement aux urbanistes et aux géographes qui auront la responsabilité d'ordonner la croissance urbaine de cette zone, au cours des prochaines décennies, de manière à produire un ensemble de forme saine, économique et esthétique. Il s'agit bien là d'un problème d'intérêt national.

Selon toutes les prévisions, la conurbation de Mississauga aura une population totale de l'ordre de 5,000,000 en 1980. Si d'autre part, l'on songe aux besoins énormes d'espace que comportera une telle agglomération, on peut se rendre compte du problème urgent que présente l'aménagement régional. Ni les services provinciaux, ni les agences locales ne sont organisés et outillés pour assumer cette tâche d'une façon satisfaisante.

L'auteur attire l'attention sur les déficiences les plus sérieuses de la planification telle que conçue et pratiquée présentement, et il étudie une solution que serait basée sur le concept d'une cité polynucléaire. Toutefois, il est essentiel à la réalisation de cette solution que les autorités provinciales s'engagent directement et systématiquement à la tâche de planification de toute cette région.

PRE-EUROPEAN TRADE BETWEEN AUSTRALIA, INDONESIA, AND THE ASIATIC MAINLAND

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THE RECONSTRUCTION of aboriginal maritime trade patterns in the Pacific Ocean is a challenging and significant, but extremely difficult, task. Indeed the full extent of trade will never be known because of the lack of written native accounts and the perishability of archaeological material such as wooden watercraft. However, enough evidence is available to indicate that trade probably had developed between northern Australia, Indonesia, and the Asiatic mainland several centuries before the European period.

Indonesian-mainland trade is, of course, known to be very ancient. Long before the birth of Christ the northern Indonesian Islands and southern India were major links in the trade route between China and the Roman Empire.[1] The Chinese and other mainland Asiatics also are known to have traded with natives in the Philippines and other southern islands for at least a few centuries prior to the arrival of the Europeans. Indeed, the scholarly work of Chau Ju-Kua,[2] a thirteenth-century customs official at a coastal port in Fukien province, indicates a very widespread geographic knowledge on the part of some of his contemporaries. His writings have been interpreted as proof that the Chinese of this time sailed to the Philippines to secure cotton and cotton goods, beeswax, coconut, and fine mats, giving in return silk parasols, porcelain, and other materials.[3] Similar mainland trading voyages undoubtedly were made to many islands other than the Philippines. Indeed, if an early Sulu manuscript referred to by H. O. Beyer is accurate, in the century prior to the Spanish arrival as many as four to five hundred junks came to this island alone every year from China, Cambodia, and other parts of Indo-China.[4]

The length of time that mainland trade was conducted with these southern islands is not known. B. W. Laufer felt that the Chinese-Philippine segment must have existed in the thirteenth century and "very likely in the latter part of the twelfth century."[5] But there are reasons for believing that such trade patterns are much older. Most important is the great knowledge of the southern islands possessed by certain Chinese of Ju-Kua's day. One way to explain this knowledge is to postulate a period of intensive nautical and commercial activity in the one or two centuries immediately prior to European exploration. The great Oceanic expansion of the Europeans certainly brought many new lands into their ken during the fifteenth to nineteenth centuries. However, Asiatic peoples such as the Chinese very probably became aware of overseas areas much more slowly by means of ancient trade patterns like that known to have been carried on with India and the west for many hundreds of years. Furthermore, the period between the seventh and tenth centuries A.D. seems to have been an epoch of empire-building throughout the Malay Archipelago. According to Beyer,[6] by the end of the eighth century A.D. the great kingdom, Sri-Vishaya, covered all the Malay peninsula, much of Siam, most of Sumatra, and part of Java. Obviously much maritime activity had to underlie such expansion, and trade between many parts of the mainland and islands seemingly must have developed by this time.

The question is whether this mainland-island traffic extended to north Australia in pre-European days. It is known that Malay mariners traded along the north coast of the southern continent at the turn of the nineteenth century.[7] Each year they voyaged down through the East Indian islands and the Arafura Sea with the northwestern monsoon and returned months later with the southeast trades. From the Australian aborigines the Malays acquired pearl shell, pearls, tortoise shell,

trepang (sea cucumber),[8] and sandalwood in exchange for dugout canoes, rice, molasses, tobacco, cloth for sarongs, knives, and other trade goods.[9] Although the ultimate destination of these Australian products is not known, the trepang acquired by the Malays was sold in part to Chinese sailors who met them in the southern Indonesian islands. The Chinese resold the trepang in Canton.[10] In European times then, the west Pacific native trade network definitely was broad enough to result in the transfer of some Australian goods to the Asian mainland.

In order to establish whether native trade was as extensive in the pre-European Pacific, the beginnings and the age of the Malay-Australian trade must be studied. Sir Matthew Flinders, who sailed the north Australian coast in the first few years of the nineteenth century, thought that these voyages were a recent development. Flinders said that after many inquiries among the natives he learned that:

> The natives of Macassas had long been accustomed to fish for trepang in the vicinity of Java, and upon a shoal lying to the south of Rottee; but about twenty years before, one of their prows was driven by the north-west monsoon to the coast of New Holland [Australia], and finding the trepang to be abundant, they afterwards returned, and had continued to fish there since that time.[11]

On the other hand, W. L. Warner believed the trade was old.[12] His basic reason was the tamarind tree. The Malays left many of these trees in Australia near their old anchorage and cemetery sites, but botanists have found them impossible to date by tree-ring analysis.[13] However, two large shell mounds were located close to certain of the trees. Warner read age in the depth of this shell in the following way:

> One tree was, by measurement, well over a foot under the accumulated shell. Since the accumulated refuse was well packed and hardened by time, this points to a considerable period of Malay contact with north Australia. The number of people using this mound was never very large, and it would take such a group a considerable period of time to throw away a sufficient number of mollusc shells to form a foot of debris about the base of a tamarind tree.[14]

However, this interpretation is not without weakness. The Australian aborigines are known to have frequented the area in which the mounds were found[15] and conceivably could have added to them.

Nevertheless the case for long-continued Malay-Australian trade still seems very strong. The eighteenth-century Malays are reputed to have discovered the Australian trepang fisheries as a result of drift voyages during the northwest monsoon. There is no reason to assume that the force and direction of these winds have varied significantly in thousands of years. From a nautical standpoint then, the Malay voyages whether accidental or deliberate should have been possible, in fact probable, throughout the thousands of years of human settlement in the west Pacific, provided that the necessary watercraft were available.

Various kinds of seaworthy craft have, of course, been utilized throughout the Pacific for an indefinite but lengthy period. Indeed, some scholars hold that early man may have come to Australia in the Pleistocene by sea rather than by now-submerged land bridges.[16] The fossil skull found near Keilor, ten miles northwest of Melbourne, apparently resembles Wadjak man well enough[17] to support the idea that this ancient inhabitant of Java migrated to Australia at least by late Pleistocene times. Some think that the migration was made upon seaworthy rafts or bark canoes, perhaps resembling those commonly observed in use among the Australian aborigines early in the European period. However, information on the seaworthiness of these craft is rare. The rafts generally seem to have been seen in bays and inland waters. The bark canoes are said by some to have navigated the open sea over distances of several miles; but others state they stayed near shore.[18]

Other craft, notably plank or dugout types comparable to those in which the Malays conducted their eighteenth-century trade, also could have been the means of accidental or deliberate voyages at an early date. Dugouts recently discovered in caves in Borneo are said to be thousands of years old.[19] With respect to their seaworthiness, very long oceanic voyages have been made on dugouts and other canoe-like craft. Sharp has written of a Gilbertese youth who escaped the Japanese by canoe in

World War II and drifted 1,500 miles to to the Admiralty Islands.[20] Accordingly a voyage of about 350 miles between southern Indonesia and north Australia seems quite possible in similar craft.

Myths and stories have been collected from the natives of Arnhem Land, which support the idea of early Malay voyages.[21] The myths are said to refer to Macassan voyages before, as well as after, 1780, and also to the arrival of drifting canoes and boats, with or without people, over a long span of time. Many of the drifts are thought to be of eastern origin, perhaps from the Torres Strait area. However a golden-brown people also seems to have come in boats, bringing rice, early in historic times.

Some cultural similarities have been reported between the Malays and the Australians, but whether their number is compatible with a long or short trade period is controversial. According to Warner,[22] a beard style, an appreciation for iron and metals, a kind of pipe, and a dugout canoe with mast and pandanus sail were introduced to some Australians by the Malay. According to D. S. Davidson[23] similar bark buckets, types of painting, profusely decorated shell pendants, stone phallic symbols, and so on are used by Malay and Australian peoples. Some of these correspondences may be the result of trade, but a few may also be due to independent inventions or to introductions by castaways: a few because the Australians were uninventive and conservative, and therefore not likely to be changed by intermittent drift voyages.

However, even if most of the cultural parallels were introduced during trade, their number remains small and can, therefore, be used as evidence that the trade was not of long duration. Presumably the number of common traits should be much larger if the Malay voyages were an ancient development. However, time is not the only factor influencing exchange of culture traits. The amount of exchange is strongly affected by other variables, such as the receptivity of the cultures involved. If one culture is eclectic, and can learn from the other, then transfer of ideas should occur with time. If, on the other hand, one culture is conservative and retrograde, like the Australian, numerous voyages by more advanced people like the Malay need effect little modification of Australian culture. Transfer is also conditioned by the over-all implications that the traits of one culture have for the other. The Australians undoubtedly rejected certain Malay traits because they were ineffective in their way of life.

A discussion of rice and the dugout canoe will illustrate these points. Both these items probably had been known in Australia for centuries, as they are mentioned in the native myths as well as in Flinder's nineteenth-century descriptions. Yet rice was never adopted by the Australians, undoubtedly because its cultivation would have necessitated the great change from a collecting and gathering to an agricultural means of subsistence, a change that these natives have refused to the present day.

The Australians apparently never made the dugout but always got it from the Malay until the government broke up their trade.[24] At this time the craft was almost abandoned by the Australians. The near-rejection was due to the dugout's having to compete with traditional Australian watercraft, chiefly the bark canoe. This craft was favoured by the Australians because it was easily and quickly constructed, with little labour and with raw materials close at hand. As a result the bark canoe was not a highly valued possession and could be discarded with little feeling of loss. The dugout, however, took more skill, labour, and time to construct. Good raw materials often were difficult to secure. It was therefore not so easily abandoned and in this sense an inconvenience to a migratory people. According to Warner the dugout finally was adopted by *some* of the Australians because its firm footing was superior to the bark canoe's flimsiness for sea-turtle hunting, shark-fishing, and spearing.[25]

Like rice and the dugout, many other *seemingly* useful Malay traits probably did not weave easily into the way of life of the Australian aborigine. The great differences between the advanced Malay and the primitive Australian ways of life, and the conservative attitude of the Australians, were the two major obstacles to *any* cul-

ture change. The small number of common traits cannot, therefore, be used as evidence that Malay trade was a development of recent or European times; better to argue that, in view of the barriers against acculturation, those changes which were effected in Australia probably required many centuries of continuous trade.

In summary, the cultural evidence must be said to be inconclusive and will not definitely settle the question of a long or short trade period. But the fact that trading voyages were taking place every year in the late eighteenth and early nineteenth centuries, and using winds and watercraft that had been available for centuries, does suggest a long trade period. This suggestion is supported by the completely native character of the trade, an indication that it probably developed independent of, and prior to, European influence. Accidental voyages, the means by which the trade supposedly began in modern days, have been so extensive and recurrent through time in various parts of the Pacific that they are fast gaining support as the major means of settlement of the Pacific islands. The high voyage frequency which undoubtedly was associated with empire-building in the Indonesian area from the eighth century to the European period implies that numerous Malays could have drifted to Australia and returned on the monsoon winds. Certain myths of Arnhem Land mention early drift voyages to that coast, and some of these castaways undoubtedly were from Indonesia. The depth of shell debris and other archaeological evidence left by the Malays also suggest more than a few decades of Malay trade, even when possible additions by the Australian natives are recognized. All this previous evidence suggests the probable development of Malay-Australian trade perhaps three to four centuries before the coming of the European. And undoubtedly some of the Australian goods secured by these early Malay mariners would be traded to mainlanders such as the Chinese, just as the trepang was in Flinders' time.

The explanation of the Malay reports to Flinders concerning the recent development of the Malay voyages probably is that the trade was new to these particular groups. Others could have been trading in Australia long before; their knowledge need not have spread. Traders are generally close-mouthed when the source of their profits is involved.

The Malay-Australian trade is of much interest to the geographer because it represents one of the uttermost arms of the extensive pre-European Pacific trade network. For the cultural geographer the trade is another means by which ideas and culture traits could have spread to various parts of the Pacific, not only as a result of planned and successful navigation within the system but also because of the many accidental voyages which undoubtedly occurred during trading operations.

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RÉSUMÉ

Il est évident que de fréquents échanges commerciaux avaient lieu entre l'Asie continentale et l'Indonésie bien avant l'arrivée des Européens ; cependant leur origine reste assez mystérieuse. Le problème consiste à déterminer si, à cette époque, les relations commerciales s'étendaient jusqu'en Australie.

Il est indiscutable que les Malais, aux XVIII^e^ et XIX^e^ siècles, avaient atteint ce continent et que les marins chinois leur achetaient des bêches-de-mer provenant des côtes australiennes pour les revendre ensuite sur le marché de Canton. Si l'on accepte les témoignages d'un certain nombre de marins malais pratiquant ce trafic, ces contacts commerciaux semblent avoir une relation certaine avec l'influence européenne. Cependant, une étude des données physiques, nautiques, archéologiques et ethnographiques met en doute cette assertion et suggère que des relations commerciales entre ces deux continents avaient probablement prise naissance plusieurs centaines d'années avant la pénétration européenne dans le Pacifique.

CHANGING CANADIAN FRONTIERS

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THE IMPRESS OF GEOGRAPHY on the economic and political history of this country is distinct and definite. Its effects on economic history are visible in, for instance, the relationship between the early fur and timber trades and the waterways, the distribution of minerals and of mining, regional types of agriculture, the nodular characteristics of population distribution, and the small total population. The impact of geography on political history has been reflected in the slow opening of the country, the policies relating to settlement and land granting, the difficulties in the formation of a transcontinental nation, the balancing of regional differences, and, indeed, the maintaining of the characteristics of a separate nation and state.

While one may tacitly acknowledge such a relationship between geography and history, the tendency is to forget that the fundamental aspects of geography remain unchanged, that history is a continuing statement and interpretation of the Canadian state and nation, and that it would be strange to find, or to expect to find, any sudden cessation of the impact of geography upon this interpretation.

It is true that specific aspects of geography have changed or have been modified. In particular, distance and communication have been affected by new techniques in transport—jet travel, the pipeline—and by new methods of social and other contacts—such as television. It is obvious, too, that Canada no longer merely lies west of Europe and north of the United States but possesses a new significance, which has precipitated new problems, as territory between Eurasia and the United States. Further, some of Canada's traditional economic difficulties have now achieved the status of acute problems: the agricultural economy associated for so long with the sub-humid grasslands is proving unsatisfactory economically and politically; agricultural pioneering, in the traditional sense of the term, is now looked on with a somewhat jaundiced eye; and that one-time suspect word, "planning," is now being uttered above a whisper in the discussion of agricultural and other land use. While none of these problems is a result of changing physical geography—obviously they are partly the result of technological and economic changes—most should be considered as a reinterpretation of the basic aspects of Canadian geography.

Indeed, recent policy statements, economic and political, may be treated with considerable pertinence as outgrowths of a belated recognition of the facts of geography, including the changing character of orientation, distance, and communication which has been thrust upon us. It is these recent statements on policies, inferred or implemented, that provide the focus for this discussion. The "frontiers" examined here are: the agricultural frontier, the northern frontier, the Canadian-American border.

These three topics have been the concern of all Canadian governments, but policy statements relating to them have gained special clarity with the present Federal Government; indeed, the initiation of some of these policies has been characterized by the trumpet call and trappings of a crusade. It is not my intention to discuss the political motives or the results of these policies; the sole intention is to point up some of the facts of Canadian geography and to examine the policies in relation to these facts. The data presented are not new. It is suggested that certain policies now apparent reflect the special conditions of Canadian geography and that no matter what government were in power the same conditions would pertain.

THE AGRICULTURAL FRONTIER

During the past few years the Canadian Government has evinced a definite interest in the problems, characteristics, and loca-

tion of the "marginal agricultural lands." In the past year, broad statements of policy concerning agriculture and, indeed, land use in general have been circulated. These policies are to be incorporated in a proposed "Rural Rehabilitation and Redevelopment Act"—an act which would provide for national planning and reorganization of a scope undreamed of except possibly in time of war or other national disaster. Two items emerge in the new design and they are connected: (1) the withdrawal of some five million acres of marginal farm land from agriculture in eastern Canada and the conversion of this land to "higher" forms of use, that is, uses to which the lands are better adapted, including forest and recreational use; (2) the removal of considerable acreage from wheat production and the encouragement of oil-seed cultivation, of farm diversification, of recreational and other possible uses in western Canada. Other suggestions refer to the stability of the farm economy: stabilizing farm and rural population; conservation of resources, soil, water, forest, and so on; the development of ancillary industries, including tourism and secondary industries. But the primary concern and the essential levers in the over-all programme are the marginal farm lands of the humid east and of the sub-humid and semi-arid west.

A necessary prefatory note to any discussion of agriculture's changing frontier is that more crops and livestock are being raised by fewer and fewer people on less acreage, that marginal farming is on the increase, and that many marginal farms are already derelict. These phenomena are partly a result of economic and technological changes but there are significant geographical facts which underlie them.

Western Canada

The identity of the Spring Wheat Region is a result of well-recognized factors which may be referred to as natural, locational, and historical or traditional. The sub-humid and even semi-arid continental climates are reasonably well suited to cereal cultivation, but generally not to mixed farming; many areas are marginal even for wheat production and some have been diverted to range use or irrigation. A relatively small population offers no great regional market for farm products and the accent has been on crop production for distant markets and on crops, wheat or other cereal, which can be easily stored and handled and can bear the costs of long-distance transportation. The early concentration on one export crop enabled the region to be occupied; but despite changing market conditions—whose impact was deferred briefly by the dry thirties, the Second World War, and immediate post-war requirements—an unhealthy preoccupation with wheat has persisted. One farm union spokesman has stated that it is our duty to maintain wheat production and storage in order to feed the hungry of the future. This is a worthy sentiment but the motivation may be less so. In any case we are confronted with an "undisposable" surplus and with large areas of grain lands which are marginal or sub-marginal producers. It should be noted that during the last twenty years there has been an increase in the Prairie Provinces of land in farms and of improved land, but a great decrease in the number of farms and in the farm population.

Four problems thus emerge in connection with the Spring Wheat Belt: How is the grain surplus to be reduced? What can be done for, or with, the marginal farm? What forms can regional economic rehabilitation take? Where lies the responsibility for initiating change, with the federal or the provincial governments? These problems occur in a particular and difficult environment; they are duplicated in a similar physical environment in the United States. Their solution is complex and involves not only planned economic change but also social and political overtones. An obvious "solution," not necessarily effective, as *vide* the United States, is the removal of acreage from production, in this case the marginal lands of the drier sections and of poorly adapted soils; accompanying this withdrawal would be the substitution of alternative uses on these lands and enforced diversification, agricultural and otherwise, within the whole region.

Eastern Canada

Agriculture and land use generally differs markedly from that of the western

grasslands. This is a humid region; there is no undisposable surplus of agricultural produce (the surplus of dairy products is not of the same order as that of wheat); diversification in land use and function is apparent even in poorer lands bordering the Canadian Shield and in that forgotten land of the Maritimes; and in parts of eastern Canada the utilization of land is complicated by competing demands of town, farm, forest, recreation, and so on—a type of competition not nearly so evident in the Prairies. Yet west and east share at least one common problem: widespread farming on land not well adapted to agriculture.

It can be stated immediately that there are huge areas in which subsistence, small-scale, part-time, semi-commercial, or any other euphemism for marginal farming is prevalent; these are mainly beyond the well-settled regions but also appear as enclaves in the populated areas. Large areas of such lands are withdrawn from agriculture each year and abandoned buildings and derelict lands are commonplace in the cut-over sections of the eastern uplands, on the Shield, and in some cleared sections elsewhere. Some four million acres were withdrawn from agriculture in eastern Canada between 1941 and 1951; while the withdrawal of this acreage is not all the consequence of operations on unsuitable lands, most of it is. The reduction in the number of farms and in farm population since 1931 substantiates the trend. This decrease is apportioned roughly as follows: New Brunswick, half a million acres; Nova Scotia, three-quarter million acres; Quebec, one and one-third million acres; Ontario, one and a half million acres. In the period 1941–1951 the number of farms in these provinces, respectively, declined by approximately 5,000, 9,000, 20,000, and 28,000. The year 1931 may be taken as the peak in farm acreage and farm numbers for most provinces in the east.

Much of the abandoned farm lands and the region with which they are associated obviously is suited to forest rather than agricultural use. The farms often are legacies of optimistic settlement by nineteenth-century pioneers whose twentieth-century descendants have been confronted with a different economic environment. Various provincial governments, particularly since the Second World War, have directed enquiries into the forest industries and into broad aspects of land use and have recognized, incidentally, that forestry is a higher form of use in these pseudo-farm lands. One broader study, by a Select Committee on Conservation in 1950, advocated that four million acres be reforested in southern Ontario; two-thirds of this suggested acreage lies on the edge of the Shield, an area of pioneer settlement between 1850 and 1890, while the rest coincides with other special physical conditions—sandy moraine, bare limestone plains, and so on—but lies within "agricultural Ontario." Such recommendations are typical of the growing acceptance in eastern Canada that not all land is agricultural land; such recognition is different from earlier policies of "farm settlement at any cost."

Therefore, the suggestion of withdrawing five million acres from agricultural production in the marginal farming regions of eastern Canada and its redevelopment for forestry or allied uses should be no great surprise: what is new is the source of the recommendations, that is, the federal government and not the individual provincial governments.

Thus in both western and eastern Canada specific basic factors of the physical environment have created fundamental problems in land use, land planning, and resource use. The Dominion government has had a long and conscious association with these problems, which has culminated in various pertinent legislation. This is evidenced, for example, in the evolution of policies relating to forestry and allied fields including such steps as the first National Forestry Conference in 1906, called by Sir Wilfrid Laurier; aspects of the work of the Advisory Committee on Reconstruction in 1941; the Dominion-Provincial Conference of 1945, which dealt with federal-provincial relationships in forestry and other matters of conservation; and the significant Canada Forestry Act of 1949. The latter empowered the government to enter into agreements with any or all of the provinces for the protection and utilization of forest resources, including reforestation, watershed protection, road-building, and management for continuous production, and

thus provided a broad basis for federal participation in provincial fields. The government has also indicated its strong interest in agriculture; the depression of the thirties in the prairies, brought on by drought, low yields, and low grain prices, led to the Prairie Farm Rehabilitation Act of 1935. The purpose of the act was to assist in the rehabilitation of the drought and soil-drifting areas of the Prairie Provinces and "to develop and promote within these areas systems of farm practice, tree culture, water supply, land utilization and land settlement that will afford greater economic security." Later, a programme of reclamation in the dike lands, shared by land owners and provincial and federal governments in 1944, led to the Maritime Marshland Rehabilitation Act of 1948; the latter, unlike the P.F.R.A., states definitely the requirement of provincial participation.

This is not a complete statement either of federal interest in conservation of resources or of the facts of physical geography pertinent to land use and land planning. But it does indicate that the interest of the federal government in land planning is not new; that the areas of concern are characterized by special difficulties of climate mainly, in the one case, and of terrain, or soils, in the other; that the Canada Forestry Act and the Prairie Farm Rehabilitation Act permit overt direction and participation by the federal government in conservation and planning of resources. The proposed Rural Rehabilitation and Redevelopment Act will deal with the same basic problems of the marginal lands, will possess inherited powers, but will state even more categorically than did the P.F.R.A. the federal government's role in functional planning in our national economy.

THE NORTHERN FRONTIER

Nearly ninety years ago the first discovery of quartz gold on the Canadian Shield was acclaimed on trains at Detroit and Buffalo with the sign "to Madoc and the Gold Fields." During the past few years the Canadian North has received rather better notices, this time as part of a major political platform. Such notices have included statements on Canadian manifest destiny in the North, ideas on sovereignty and the need for the effective occupation of northern Canada, and claims of the inevitability of economic development following transportation facilities. As a result of such publicity, the North has become for most Canadians, something more than background Canadiana.

Yet this frontier has been with us for a long time, not as a line, but as an area. Its definition to one federal official is Canada north of the sixtieth parallel, "but, not surprisingly, Quebec does not fit the pattern while Labrador must also be considered part of the North. . . ." No attempt to define the Canadian north is made here; it is satisfactory to think of it as that area lying north of settled Canada which presents special difficulties of climate, soils, terrain, and communications.

This region has been approached from the northern seas, the south, and the west; mainly, however, successful penetration and occupation have been from the south. Farm and forest industries have been pushed to the southern fringes and have been overtaken, or often led, by developments of hydro-electric power and particularly of mining. Strangely enough, the one truly significant settlement near the tree line, Churchill, now some thirty years old, was born to the prairie farmer rather than to the Montreal, Toronto, or New York entrepreneur. While the North attracted comparatively little public interest prior to World War II, its development had been a continuing if unspectacular phenomenon, achieving considerable success: in mining, at many locations, and agriculture, as in the Peace River District, mainly within the provinces; in establishing the oil resources of Norman Wells and later the use of pipelines, with the Canol project; in developing mines within the territories and establishing plane, water, and even road communications in many areas. By the nineteen-fifties a great deal was known of actual and potential resources. Knob Lake, Pine Point, Lynn Lake, Eagle Plain, the Peel Plateau, and others had resources suspected or prospected and they would be opened up when market and other conditions were right.

New northern development began during and after the Second World War.

First was the building of air fields, part of the staging routes, later significant as landing fields for civilian use; second, the concepts of polar defence and arctic warfare which led to the use of Churchill as a combined Canadian–United States training base and to the establishment of warning system and retaliatory bases; and third was cognizance of the necessity for establishing Canadian sovereignty in the northern territory.

But the general character and economic possibilities, climatic and geological, have long been recognized, though specific items within the makeup may not have been known. Nothing discovered during the past twenty years has greatly modified the long-standing appreciation of this as a very large and very special part of the national territory in which developments would be particular and isolated. Probably the only real modification of traditional appreciation was the new orientation introduced by the concept of a "trans-polar" location and the consequent participation of non-Canadian service personnel in manning various stations.

This summarizes the status of the North some four years ago: a fairly active and successful programme of exploration and development by private enterprise, based upon traditional attitudes of supply and demand and aided in the traditional manner by federal and provincial governments (assistance in road building, etc.); a national concern over control of northern defence bases; a growing concern over the status of Canada as a supplier of raw materials, and, with this, concern over the tremendous foreign investment in the Canadian economy. The scene was set and, no matter what government was in office, that government would be confronted with the responsibility of supervising, controlling, and even directing the inevitable new developments in a remote and difficult region. Furthermore, the government concerned would have to take a stand, or a straddle, on the implications of Canadian-American relations in the north. Without practising hindsight or involving political criticism, the present government may have overstated its claim for northern development. The way was already set and there was little opportunity for choice. Despite this, many aspects of the general programme have been worth while: the Roads to Resources and Development Roads programme, not really new (there is a history of more than a hundred years of such assistance, not to mention similar assistance provided by the previous government in power), is serving a very useful purpose, while the Department of Northern Affairs has been active and successful in a fashion never previously possible in the North.

The northern frontier remains a very special area. Because of its peculiar geographical conditions it is probable that development should be planned and at least partly underwritten by the government; this could help achieve the broadest base for exploitation and provide a sense of Canadian ownership. Planned or haphazard, development will occur.

THE CANADIAN-AMERICAN BORDER

For at least fifteen years this subject has been a hardy annual in geography examinations in certain Canadian universities; for a longer period it has been a topic of general academic interest; and since the American Revolution it has been a problem in international relations. The handshake, the flags side by side, and the reverent, or ignorant, acclaim of "our undefended border" have never satisfactorily solved the difficulties. The reality, largely a function of geography, is commonly expressed as the constant conflict in maintaining the tenuous east-west ribbon that is Canada against a pull to the south into the orbit of the United States.

The geographical conditions which are conducive to Americanization are common knowledge. In many of its physical attributes Canada is an extension of the United States (or vice versa); the forms of the economy, agricultural and industrial, are generally continued across the international boundary; even the population densities tend to be comparable in zones which cross the border. Added to these zonal similarities is the fact that the population of the United States is one hundred and eighty million, compared with eighteen million in Canada, and thus it

constitutes a significant magnet or even a threat, depending upon the point of view. Certain relationships become almost inevitable. Socially and culturally the two countries have grown closer, particularly because of the ease of communication and of visual and physical contact.

Canada itself has been variously described as a nation of separates, a linear state, a nation joined by a railroad, within which distance and widely separated population nodes have prevented national unison despite the apparent unity of the state: both economic and cultural sectionalism are evident. Its economy still has a colonial aspect because of the tremendous exports of raw materials, particularly from the Shield and prairies, and because of the huge imports of manufactured goods; Canada has become, in particular, a major source of raw materials for the United States and a major market for American manufactured articles.

Certainly many of these facts result directly or indirectly from the nature of Canadian geography. The difference in both numbers and distribution of population are in fair measure attributable to geography. The size of the Canadian population, in turn, has helped to place a stress upon the export of non-processed products, and has aided, by default possibly, the domination of the domestic market by American finished products; it has been conducive to the flow of outside, now mainly American, capital into all fields of production, and it has led to a growing belief in American economic domination.

Roughly paralleling in time the growth of American capital investment in Canada was the first realization of the special military location of this country. In 1938 Canada was characterized by a tiny population and a somewhat "off track" situation on the Mercator map. By the end of the war it had emerged as an area of consequence in hemispheric defence, necessary in North American defence, and vital in the newly developed concept of polar defence. It had changed its character to a Middle Power, or possibly to a Power in the Middle, and it had assumed a special place as part of North America. This new role was acquired merely as an accident of geographical location. The two faces—economic and military-political—of Canadian-American relations since 1939 have continually produced new forms of integration between the countries, and in so doing have induced a preoccupation with north-south geography and the fear of the eventual absorption of Canada into a North American unity.

The concept of absorption, or loss of identity, has been freely discussed during all periods of Canadian history. The counterweight would seem to lie in political and economic alignments which would overcome the pull into the United States orbit. Such counterweight has been considered. In 1952, and since, Lester Pearson has suggested the necessity for economic as well as military alliance with the Atlantic community. The present Prime Minister has stressed the need for new economic alignments ("free trade" with the United Kingdom, for example) in order to rectify the imbalance of trade with the United States. He and his government, and for that matter the opposition parties, stress constantly the necessity for wider trade relationships and for wider military and political alliances which go further than North American defence. Certainly the Prime Minister's early nationalistic appeal for northern development by Canadians, the stress on Canadian sovereignty and on ownership and industrial development by Canadians are part of a great reaction against the apparent creeping economic and political unification of North America. These are in many ways appeals to Canadianism and against geography.

CONCLUSION

The stated intention of this study was to examine certain national policies in relation to the geography of Canada. Not only has the role of geography been strong throughout Canadian history, but also major policy statements, particularly of the past few years, have recognized its impact. This recognition includes the appreciation of the nature of the internal geography, and of the consequent difficulties of internal growth, together with the special character of Canadian space relations, or its "international" geography.

Two trends emerge from an analysis of geography and policy. It has become evident that leadership by the federal government in national economic planning is to play an increasing part in the Canadian future. Further, it would seem that in its external relations Canada, to avoid a "North American" identity, has consciously attempted both the development of and participation in wider economic, political, and military alliances. Thus both internal and external policies have a basis in the geography of Canada.

RÉSUMÉ

Les conditions géographiques ont toujours eu, au Canada, une influence marquante sur l'économie et les idées politiques. Il n'est donc pas sans valeur de considérer les idées politiques formulées récemment comme le résultat d'une prise de conscience des faits géographiques. Ce sont ces idées politiques contemporaines, réalisées ou simplement énoncées, qui constituent l'objet de cet article.

Les zones-frontières dont il est ici question se groupent sous trois définitions : *a*) une zone pionnière ; *b*) une portion de contrée voisine d'une zone non-peuplée ; *c*) une frontière séparant des états. Dans cette étude, ces définitions sont appliquées respectivement à la frange pionnière agricole, à la zone-frontière septentrionale et à la frontière Canada-U.S.A. Le Gouvernement Fédéral actuel a énoncé la frange pionnière agricole, à la zone-frontière tières avec plus de clarté que n'y avaient mis ses prédécesseurs ; mais il est probable que des décisions semblables auraient été prises, quel que fût le parti au pouvoir, puisque ces décisions auraient eu à tenir compte des mêmes faits géographiques.

L'auteur n'entend pas analyser les motifs ou les résultats politiques de ces énoncés gouvernementaux ; il désire toutefois souligner l'importance de certains faits de géographie et faire l'examen des aspects de la politique nationale qui en relèvent.

THE GAS INDUSTRY IN EUROPE

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COMPARED WITH the electricity and oil industries, the rate of growth of the European gas industry has been relatively slow in recent years (see Table I). Between 1950 and 1958, gas consumption in the O.E.E.C. countries (listed in Table II) increased by 58 per cent, whereas electricity increased by 86 per cent and oil by 156 per cent. Nevertheless, the gas industry is by no means in a static condition; in fact, it is undergoing a series of highly significant changes of which three stand out in particular. There is a widening range of sources from which gas is obtained; extensive pipeline networks are being laid; and new technical and economic forces operating upon the industry are modifying the geography of gas production.

Formerly, the gas industry of Europe was based entirely upon the conventional gasification of coking coal. However, as variations in load developed, particularly with the increased use of gas for cooking and space heating, the manufacture of water gas from coke and oil became more common in order to meet peak demands. Thus a process was initiated whereby an increasing diversity of gas sources came to be used, and an association began between the oil and gas industries. This association was primarily the result of the competition which gas has had to face from alternative types of energy. The industry has been forced to search for more economical raw materials than coal, and has developed several techniques whereby gas may be produced from oil. In France, for example, a wide range of oil and oil products—butane, propane, gas oil, fuel oil, paraffin, and light fractions—are all used through cracking or reforming for gas production. Further, as a consequence of the expansion of the oil industry in Europe in recent years, tail gases from the refineries have become increasingly available, and, after reforming, have been used to supplement supplies of gas; their use has meant yet stronger links between the oil and gas industries.

Not unnaturally, the production of gas from coal has been affected by these changes; competition from this alternative raw material has led to the development of new techniques which will allow the use of poorer grades of coal than were previously used, plus, in the Lurgi technique, a means whereby coals can be completely gasified. The latter is being used in both Germany and the United Kingdom. In spite of these technical developments and the growing use of oil, in the production of gas in gasworks (that is, in the manufacture of "town gas") coal remains the primary raw material, and conventional techniques using coking coals still predominate. The greater part of the 23,880 million cubic meters (m.c.m.) of town gas which were produced in the O.E.E.C.

TABLE I

CONSUMPTION OF ENERGY IN O.E.E.C. COUNTRIES*
1950–1958
(millions of tons of coal equivalent)

	1950	%	1958	%	% change
Gas	33.2	9	52.5	10	+58.1
Electricity	23.4	6	43.6	9	+86.3
Oil	56.9	14	145.7	28	+156.0
Coal	282.1	71	275.5	53	−2.4
TOTAL	395.6	100	517.3	100	+30.7

*Source: O.E.E.C., *Gas in Europe*, Paris, 1960, p. 50.

countries in 1958 was made from coal by such methods. The largest producers of this gas were the United Kingdom (14,340 m.c.m.) which dominates this type of gas production in Europe, the Federal Republic of Germany (3,760 m.c.m.), and France (2,666 m.c.m.).

In the inter-war years the value of coke oven gas was widely recognized for the first time. Although the principal consumer of this gas has always been the iron and steel industry itself, the linkage of supplies with town gas distribution systems led to its use in wider industrial, commercial, and domestic markets. The expansion of iron and steel-making capacity in Europe since 1945 has added to the supplies of this type of gas, and the growing use of oil in recent years for the firing of the steel industry's furnaces has released yet further quantities for general consumption. By far the largest producer of coke oven gas is the Federal Republic of Germany (20,830 m.c.m. in 1958, or 45 per cent of the production of all the O.E.E.C. countries), followed by the United Kingdom (21 per cent) and France (11 per cent). Recent years have also seen a re-evaluation of the usefulness of blast furnace gas. Whereas this gas was at one time usually wasted, it has come to be used extensively for the underfiring of coke ovens and some of the furnaces of the steel industry, as well as for the generation of electricity. Its low calorific value demands that it be used close to its source, and as a result it is invariably consumed at or adjacent to iron and steel works. About 75 per cent of the production of blast furnace and coke oven gas is in the Federal Republic of Germany, France, and the United Kingdom.

Producer gas is another low calorific value gas; although its use is not widespread throughout Europe, it is used extensively in Germany, where output is only a little smaller than that of town gas production. Producer gas is used to underfire coke ovens, and to provide heat for the iron and steel, the chemical and the glass industries.[1] In Germany, particularly, a close interconnection between the gas, iron and steel, coal and chemical industries has been developed to make the best possible use of different gases by mutual exchange.

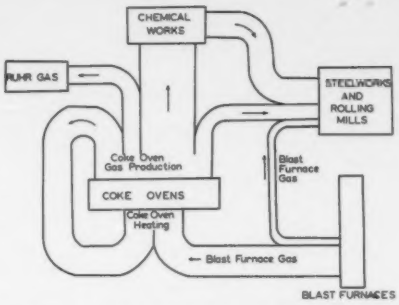

FIGURE 1. *Gasverbund* in the Ruhr (after Gummert).

This *Verbundwirtschaft* is perhaps best illustrated by Figure 1.

The most recent addition to the widening range of gas sources is natural gas. Although it first made its appearance in Europe before 1939, it is only since the war that reserves have been exploited on a large enough scale to have a major effect on energy patterns. The largest producer of natural gas is Italy, with an output of 11,210 m.c.m. in 1958. Very much smaller, but increasing quantities are produced by Austria (1,870 m.c.m.), France (1,490 m.c.m), and the Federal Republic of Germany (1,310 m.c.m.). Looking to the future, however, French plans for the expansion of natural gas production are the most ambitious; if they are realised, these plans will bring production in France up to a level not very different from that of Italy within a few years.[2] Recent finds in the Netherlands suggest that that country, too, may become a major producer in the next decade or so.[3]

The second major development of the European gas industry in recent years has been the laying, linkage, and extension of pipeline networks. This has resulted in several extensive gas distribution systems throughout the continent. In Germany, for example, where there is a high degree of concentration of gas production in the Ruhr area, a long-distance gas grid extends from the gasworks and coke ovens of that region to the northeast beyond Hanover and to the south beyond Mannheim; from the latter city there are mains linking this system with the gas mains of the Saar and

TABLE II

GAS PRODUCTION IN O.E.E.C. COUNTRIES*
1958
(in Teracalories i.e., 10^{12} calories)

	Gasworks	Coke Ovens	Blast Furnaces	Natural Gas	Total
Austria	869	2,989	4,129	7,866	15,853
Belgium	366	13,057	18,699	873	32,986
Denmark	1,521	—	—	—	1,521
France	11,248	21,262	47,247	6,245	86,002
Federal Republic of of Germany	15,760	87,483	57,947	5,487	166,677
Saar	—	8,444	11,118	—	19,562
Greece	65	—	—	—	65
Ireland	672	—	—	—	672
Italy	3,158	5,831	5,236	47,102	61,327
Luxembourg	100	—	15,530	—	15,630
Netherlands	3,020	12,380	3,100	1,776	20,276
Norway	185	—	—	—	185
Portugal	283	—	—	—	283
Sweden	1,390	200	2,700	—	4,290
Switzerland	1,430	—	—	—	1,430
Turkey	391	1,113	678	—	2,182
United Kingdom	60,127	40,772	39,000	168	140,067
TOTAL	100,585	193,531	205,375	69,517	569,008

*Source: O.E.E.C., *Gas in Europe*, p. 103.

northern France (Figure 2). In the United Kingdom, on the other hand, there is no long-distance pipeline system: instead there have been laid a series of extensive regional gas grids.[4] Largely as a result of the wide distribution of both the coal fields and the iron and steel industry, the nature of production techniques, and the administrative structure of the industry (a series of largely autonomous regional Boards), a national gas grid has yet to be built in Britain, although all the evidence points to the necessity for one in the near future.[5] In France, local pipelines have existed in the Paris region and (related to the iron and steel and coke industries) in the north of the country for some time. More recently, a long-distance gas transport system for the movement of natural gas found at Lacq in the southwest to the large markets of the country, especially Paris, has been built (see Figure 2). The distances involved in French gas transport are very much greater than in the case of Italy, where natural gas has been found in the Po basin and in Sicily. It is in the north, however, where industries provide a ready market for gas, and where the major pipeline construction has taken place (see Figure 2).

The third recent major development in the European gas industry concerns the changing geographical pattern of production. The gas industry of Europe was at one time composed of a series of independent gas works, each serving its own town and the surrounding suburban markets. Now, besides the effects of the new sources of gas upon the distribution of production, the techniques and economics of town gas manufacture and distribution have radically altered; the result is an industry undergoing a revolution in its geography. Pipelines have been used to interlink a large number of conventional gasworks and their distribution systems, so that many of the smaller works have closed down since their markets can be more economically supplied from larger plants. Between 1950 and 1958 the number of gasworks in ten of the largest producers in Europe fell from 2,377 to 1,436 (Table III). With these closures, production of gas from coal has become concentrated at the larger markets, and at points with easy access to coal, either on the coal-fields or along cheap transport routes. Modern coal gasification techniques, which allow the use of low-grade coals and the total gasification of coal, further encourage the location of

production upon the coal-fields. The pull of the coal-field increases as the coals used in gasification become poorer; for as the volume of coal required to produce a given quantity of gas becomes greater, the transport costs for the movement of coal off the coal-field also become higher. In the case of total gasification, the attractive force of the coal-field for gas production is even greater—for there is no coke left as a by-product and requiring distribution to market.

The increasing use of oil is also having its impact upon location; in this case, large markets and sites adjacent to oil refineries are proving to be good locations for gas production. The geography of gas produced as a by-product—coke oven and blast furnace gas—is ultimately governed by the factors affecting the location of the

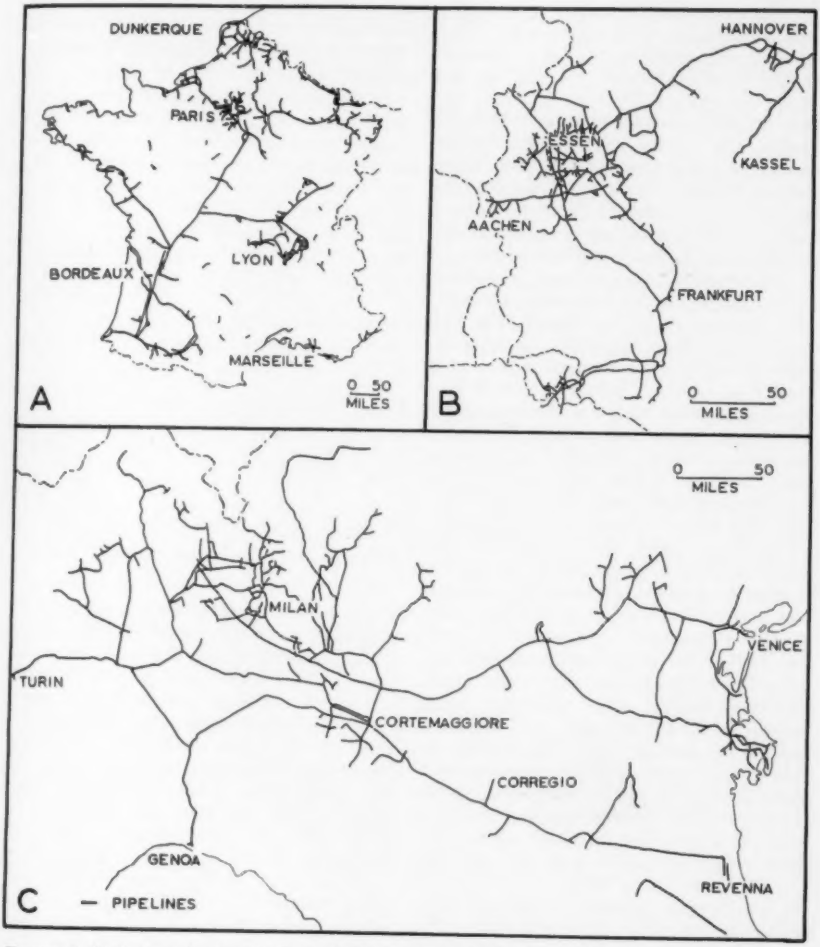

FIGURE 2. Major gas pipelines in Europe: A, France; B, Federal Republic of Germany; C, Italy.

TABLE III

NUMBER OF GASWORKS IN EUROPEAN COUNTRIES*

	1950	1958
Austria	21	18
Belgium	17	3
Denmark	107	96
France	507	222
Federal Republic of Germany	325	287
Italy	175	138
Netherlands	126	48
Sweden	37	25
Switzerland	73	69
United Kingdom	989	530

*Source: I.G.U. and E.C.E., Geneva.

coke industry and the iron and steel industry. And to this increasingly complex picture of gas production has been added the exploitation of natural gas, the deposits at Lacq in southwest France and at Cabiaga and Contemaggiore in Italy, the fields in Austria and in the Netherlands.

The characteristics of gas production within the O.E.E.C. area vary considerably from country to country. In the Federal Republic of Germany, for example, although supplies are obtained from a wide variety of sources, including natural gas, the major source of gas is the coke oven. Neglecting the low calorific gas from blast furnaces, about 80 per cent of gas sales come from the coking plants of collieries and iron and steel companies located mainly in the Ruhr.[6] In the United Kingdom, on the other hand, the gas industry still relies basically upon conventional production methods. Oil is used as a raw material, and new methods of gas production from coal have been pioneered, but the principal method of manufacture remains the conventional gasification of coking coals. Methane drained from collieries, small quantities of natural gas, and imported natural gas are also used.[7] The French gas industry, in contrast, has become more and more a clearing house and a transporter of gases from different sources, and less and less a producer in recent years. Supplies of gas purchased from the iron and steel industries have been used in addition to considerable quantities of tail gas from refineries and natural gas from Lacq. The result is that these purchased and natural gases together represent more than twice the production of *Gaz de France* in its own gasworks, and their dominance is increasing.[8] The Italian gas industry is now the fourth largest in Europe. It has even more of a transporting, rather than a manufacturing, role than its French counterpart. Some 77 per cent of its gas comes from natural sources; 9.5 per cent and 8.5 per cent are obtained from coke ovens and blast furnaces respectively; thus only 5 per cent is manufactured.[9]

Within the O.E.E.C. area it is possible to distinguish four main zones in which the major characteristics of gas production are different (Figures 3 and 4). On the periphery of the area there are two zones, each with only a small volume of production. Norway, Sweden, and Denmark make up Zone I. There, most energy requirements can be more cheaply and conveniently supplied by hydro-electricity. Switzerland, with its small gas production and large hydro-electricity resources, is an outlier of this first zone. Zone II lies in the south of the continent and comprises a series of countries—Spain (not in O.E.E.C.), Portugal, Greece, and Turkey —whose total energy requirements are small because of their poverty and economic backwardness. Ireland, a country with relatively small energy demands, is a

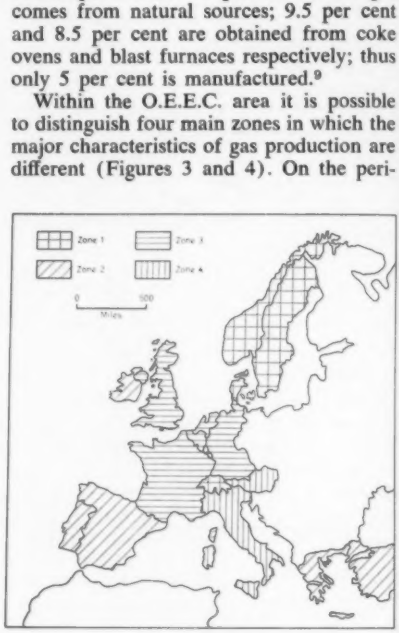

FIGURE 3. Gas Production Zones in Europe.

detached part of Zone II. The greater part of Europe's gas (85 per cent) is produced in Zone III which comprises the United Kingdom, the Federal Republic of Germany, France, Belgium, the Netherlands, Luxembourg, and the Saar. The major feature of gas production in these countries is that, although large quantities of gas are produced from a considerable variety of sources, coal is by far the most important source. Two countries to the south and east—Italy and Austria—make up Zone IV. The chief characteristic of this zone is the outstanding importance of natural gas in total gas production. Naturally, these zones are by no means rigid and unchanging. For example, France is in the process of moving from Zone III to Zone IV. The recent discoveries of natural gas in the Netherlands, and the prospect of importing supplies of natural gas from the Sahara, both suggest that changes in the patterns of production and the sources of European gas are imminent. Indeed, it can be argued that they are desirable.

It is instructive to consider the rate of growth of the gas industries of different countres in the O.E.E.C. area. In recent years there has been a decline of gas consumption in Scandinavia, Ireland, Switzerland, and Greece, and the rates of growth of Spain, Portugal, the United Kingdom, Germany, Belgium, and the Netherlands have been very slow.[10] Only in Austria, France, Italy, and Turkey has there been a rapid increase in consumption. With the exception of the latter, it is immediately apparent that it is in those countries which have found and are actively developing resources of natural gas that the growth of gas consumption is at all lively. This underlines the fact that natural gas is by far the most competitive form of gas. It also points to the need for the gas industries of those countries which have not found domestic natural gas on a large scale either to increase their search for domestic supplies, or to negotiate for imports. This is essential if they are to maintain, let alone increase, their share of the energy market.[10a] The only other recourse —if they are to expand—is to increase production of low calorific value gas from coal by the cheap Lurgi technique and then to enrich it with either methane or lique-

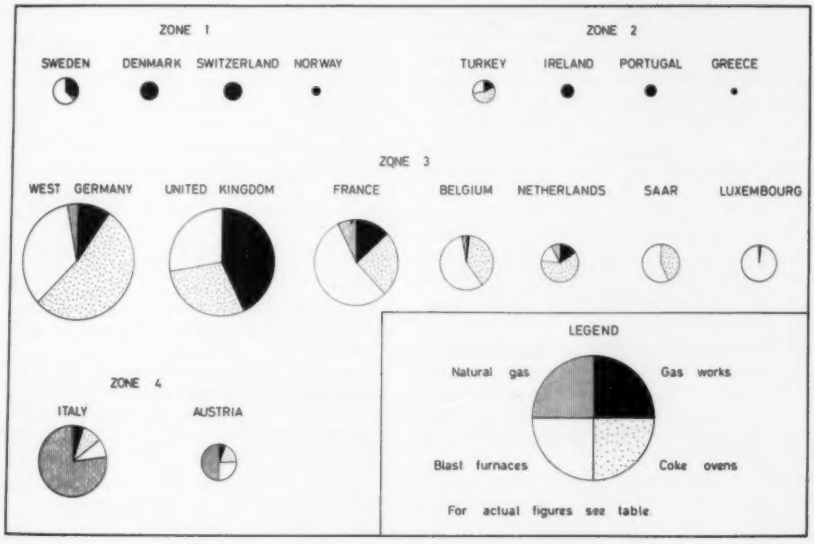

FIGURE 4. Production in 1958 for each European Zone.

fied petroleum gas imports.[11] The uneven distribution of natural gas resources will necessitate the import of this gas for some countries, which raises, of course, a political and strategic problem in so far as many are reluctant to become too dependent upon overseas supplies of energy. On the other hand, a dependence upon energy imports is a not unusual state of affairs in Europe. In 1957 Austria imported 22 per cent of her energy needs, Belgium 26 per cent, Denmark 94 per cent, France 44 per cent, Germany 9 per cent, Greece 71 per cent, Italy 57 per cent, Luxembourg 100 per cent, Sweden 60 per cent, and the United Kingdom 16 per cent.[12]

The European gas industry, then, is at present finding itself subject to a series of changes which are altering its patterns of production and distribution. The variety of the gas industry throughout the different countries of Europe stands in strong contrast to its American counterpart, the uniformity of which bears all the marks of the richer resources of natural gas, political unity, and the more readily available capital on that continent.[13] At the same time as there is variety in the European industry, however, there is also a common characteristic of change throughout the greater part of the O.E.E.C. area; the forces of economics, technology, politics, and resources are together moulding a new role for the gas industry on the energy map of Europe.

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RÉSUMÉ

Cet article est consacré aux aspects géographiques dominants de l'expansion de la production du gaz en Europe pendant ces dernières années.

L'auteur met l'accent, notamment, sur la diversité grandissante des sources de production, la pose de nouveaux pipe-lines et sur les objectifs techniques et économiques qui tendent à modifier la géographie de la production du gaz.

Les diverses caractéristiques de la production du gaz dans les différents pays de l'O.E.C.E. servent de base à la discussion des quatre zones d'approvisionnement, auxquelles l'auteur reconnaît un certain nombre de traits communs.

Dans la conclusion, il présente des commentaires sur la croissance de la production du gaz en divers pays et sur l'importance de la concurrence que le gaz naturel offre aux autres sources d'énergie.

Geographica

GEOGRAPHY AT THE TENTH PACIFIC SCIENCE CONGRESS

APPROXIMATELY eighty geographers were among the two thousand scientists who invaded the University of Hawaii and Waikiki beach for the 10th Pacific Science Congress, August 21–September 6, 1961. About half the geographers were from the United States and the second largest group travelled from Japan. Most countries bordering on the Pacific Ocean were represented, including the U.S.S.R. but not China (except Formosa). All major European nations sent delegates, and scientists were also present from such less likely places as Pakistan and Ghana. To the writer's knowledge, only four geographers from Canadian universities attended. Each presented at least one paper.

The Congress comprised nine sections (agriculture, anthropology, biology, conservation, forestry, geography, geophysics, public health, and scientific information), most of which were subdivided. For example, the section of geophysical sciences included divisions of meteorology, oceanography, and solid earth sciences. Of these the oceanography division seemed particularly active. Geography was not subdivided.

Papers were concerned mainly with problems of the Pacific realm, but in addition made reference to relevant experience and findings obtained elsewhere. The geography sections held eight pre-arranged sessions for which papers had been invited. These were: (1) Geographical Exploration in Relation to the Development of the Pacific Map, (2) Mechanization of Rice Agriculture, (3) Urbanization in the Pacific Realm, (4) Pacific Island Terraces, (5) Current Development in Geographic Thought, (6) Pleistocene and Post-Pleistocene Climatic Variations in the Pacific Area, (7) Peasant and Plantation Agriculture, and (8) River Regimes and Flood Problems. In addition, open sessions of two International Geographical Union Commissions were held: World Land Use Survey and Humid Tropics. Four sessions were held at which contributed papers (rather than invited) were presented. These included physical geography (6 papers), human geography (7 papers), regional geography (10 papers), and cartography (6 papers). Geographers also took an active part in sessions outside the geography section, for example, in the Congress-wide symposium on "Man's Place in the Island Ecosystem," and in the meetings on "The Role of Cultural Values in Land Use" in the conservation section.

While it is not easy to evaluate a Congress of this nature, the writer found the full programme of formal proceedings of a generally high quality and stimulating if taken in manageable doses. Perhaps the major value of the Congress, however, lay outside the formal proceedings, in the opportunity to meet and discuss problems of mutual interest with scientists from other countries. This is especially true of those countries with which contact is ordinarily limited. This mutual interchange of ideas was continued in the post-session field trips to various parts of the islands. These were generously subsidized for foreign delegates by the American host institutions, the National Academy of Sciences, the Bernice Pauahi Bishop Museum of Honolulu, and the University of Hawaii.

In view of the value of this Congress it is to be hoped that a larger group of Canadian geographers will be able to attend the 11th Pacific Science Congress. It is expected to be held in Tokyo in 1966, at about the same time of year. Canadian geographers have much to contribute and much to gain from this eminently worthwhile venture in international scientific cooperation.

There is no plan to publish the Congress proceedings as a whole, and publication of papers and symposia will take place piece-

meal. Information about specific papers or publications can be obtained from the Pacific Science Association, c/o Bernice P. Bishop Museum, Honolulu, Hawaii. An eighty-page paperback by A. P. Elkin describing the Association and its history is also available, as well as a volume of abstracts of papers presented at the 10th Congress.

[IAN BURTON]

RESOURCES FOR TOMORROW*

THE RESOURCES FOR TOMORROW CONFERENCE, held in Montreal, October 23–8, 1961, under the auspices of ten provincial governments and the government of Canada, is of great significance in the history of the study of resource utilization in this country. More than 650 delegates from government, civil service, industry, universities, professions, and interested citizen groups were brought together for discussions on the status of renewable resources. Among those present and taking prominent part in the deliberations were many members of the Canadian Association of Geographers. Announced by the Prime Minister of Canada in February 1958, the Conference was more than three years in preparation.

Some months before the Conference, two volumes (1,061 pages) containing eighty background papers were issued to the participants. In them the resource management problems of agriculture, water, regional development, forestry, wild life, recreation, and fisheries were considered. These volumes were also on sale to the general public and will long provide useful reference material on resource use in Canada. A third volume containing the proceedings of the Conference will be issued later.

The Conference was well organized. The first and last days were occupied by plenary sessions, the first to lay a broad foundation for the ensuing discussions, the last to draw a few conclusions. Between were four days of workshops—more than thirty in all—in which specific topics in the various fields were discussed in the light of the background papers and the varied experiences of the participants. On the day before the opening of the Conference, the leading participants had been assembled for a complete briefing in workshop procedure. This precaution notwithstanding, it was at times difficult for chairmen to prevent the waste of time in fruitless discussion of irrelevant matters.

In this brief review attention will be drawn only to a few topics which are of particular interest to geographers—agriculture, urban growth and resources, and the concept of the urban-centred region.

As it should be, agriculture was quite fully treated. Background papers laid the framework for discussion of demand and supply in relation to agricultural production, the land base, soil fertility, agricultural technology, and problems of rural sociology. Two workshops were conducted: (*a*) Undertaking physical works for land maintenance and improvements; (*b*) Withdrawing submarginal lands from agriculture and shifting to higher uses.

It can be seen that the two topics are rather closely related and that the expansion of the land base of the agricultural industry was given little consideration. In fact the general tenor of reports of the discussions showed that many people believe Canadian agriculture to be overexpanded, resulting in both uneconomic enterprise and the production of embarrassing surpluses which cannot be absorbed by the world market. Under such conditions the transfer of submarginal crop land to grazing and forestry should be fostered,

*ED. NOTE: In view of the national significance of this Conference, a further analysis of its accomplishments will be published in a subsequent issue.

while every attempt should be made to increase the efficiency of good land. Among the more notable presentations was that of Professor L. H. Shebeski, entitled "Implications of Technological Change for Agricultural Productivity." It was predicted that about the same area of land would be cultivated in 1980 as at present, while population will have increased by 10 millions. Research in plant breeding and plant nutrition will increase the per acre yield of field crops by 35 to 40 per cent, but, because of the increased demand for livestock products, grain surpluses will have almost disappeared. Moreover, it will be necessary to protect first-class land which is suitable for special crops from indiscriminate transfer to non-agricultural uses.

Two workshops discussed "Urban Growth and Resources": (*a*) Providing for urban growth without wasting agricultural land and other renewable resources; (*b*) The control of air pollution generated by the growth of cities.

There were also two workshops on "Urban-centred Regions": (*a*) Controlling the impact of urban growth on resources; (*b*) The evolution of governmental processes to meet the challenge of regional development.

There were some very interesting background papers, including "The Loss of Farmland in the Growth of the Metropolitan Regions of Canada" by A. D. Crerar, "The Impact of Urban Growth on Agricultural Land During the Ten-Year Period from Jan. 1, 1951, to Dec. 31, 1960" by L. O. Gertler and Joan Hind-Smith, and "The Edmonton District: A City Centred Multiple Resource Region" by F. Marlyn and H. N. Lash. It was demonstrated that a developing urban area is surrounded by a shatter-belt or "urban shadow" from two to five times as great as the area required by urban building, the "shadow" being defined as the area of farmland lying idle or subject to pressure pushing it out of agricultural production. On the average, 382 acres were needed for the accommodation of every 1,000 persons added to the urban population. It was further shown that the influence of large metropolitan districts could be felt throughout a commuting distance of 40 to 50 miles from the city centre. It was felt that such "scatter" or "sprawl" was detrimental to both sound urban development and a continuing rural economy.

The question of controlling the impact of urban growth was introduced by Mr. Humphrey Cawer. He discussed controls in terms of four concentric zones: (*a*) the built-up city, (*b*) the "shadow" or "shock area" into which the city is expanding, (*c*) the agricultural area, which must be conserved at all costs both for its agricultural value and for its suitability as open space, (*d*) the peripheral area which is not affected at present. The chief problem area, he said, is the "shadow" where people are half rural, half urban, and which should be held in trust for the urban people. After lengthy discussion it was agreed that the "shadow" should be under the control of either the metropolitan municipality or a provincial authority.

What general conclusions, specific objectives, and concrete plan of action came out of this Conference? Despite the Prime Minister's offer to set up a National Resources Council and the formation of a new Canadian Council on Urban and Regional Research, it is evident that only very preliminary steps have been taken. It is far more important, at this time, that the government of Canada is prepared to contribute to the cost of recurring conferences of this kind. It was obvious to observant participants, and also in the workshop reports of the Conference journal, that there was much talking at cross-purposes, much misunderstanding of the objectives and opinions of experts in different special fields. It is necessary, of course, that such conflicting views be examined, but it is clearly impossible to render irrevocable decisions and to indicate appropriate executive action now. Such contentious issues should be further examined in detail by smaller, more penetrating, and precisely directed groups, which might later prepare logical conclusions for a larger conference. Three years of preparation went before this conference; it is not too early to begin the groundwork for the next.

The implications are clear for all Canadian geographers. The emphasis in many

sections of the Conference was upon regions—regional definition and regional development—and, in these discussions, the participating geographers contributed significantly. There are, however, many unsolved regional problems which should be investigated. Resources may be fully utilized only within a regional framework, to the understanding of which geographical research is expected to contribute.

[D. F. PUTNAM]

REVIEWS

The Human Use of the Earth, by PHILIP L. WAGNER, The Free Press of Glencoe, Illinois, 1960, 270 pp.

THE TITLE of this book is somewhat misleading. It is not a description of the use man has made of the earth, but, rather, a methodical description of the social and economic systems which man has devised in utilizing and adapting his physical environment.

In the introduction Wagner expounds his general philosophy of geography. He admits that the physical environment has a considerable effect upon man's activities ("An environment is only an environment in relation to something that it environs"), but argues that the artificial environment created by man has a much greater influence. Wagner postulates that there is an order and regularity in the geography of man's works. The purpose of the book is to formulate "general propositions about the considerations that govern the location of all man's creations," and to interpret "man's use of the earth as the orderly function of technical systems which interact with nature under definite limiting conditions."

The body of the book categorizes and describes in detail man's ways of livelihood: his social and economic organization, his means of production, and his methods of distribution and consumption. The subheadings of Chapter 6, "The Means of Production," give a good idea of the treatment of the major topics of the book: (i) The meaning of work, (ii) Facilities and tools, (iii) Varieties of capital, (iv) Domestic plant and animal capital, (v) Cropland and cultivation, (vi) Capital and nature. In the section on the varieties of capital, the author outlines a taxonomy of capital in which he goes into great detail in distinguishing between things such as tools, facilities, instruments, machines, and automata. A knife is a tool, a pot a facility, a stick an instrument, a cart a machine, and a calculator is included under the heading of automata.

Two maps have been included. One shows the location of thirty-seven tribes mentioned in the book. The other shows the location of the different economic organizations of the world in 1950. Unfortunately, the attempt to overlap one shading pattern over another has made the latter map almost impossible to read.

After a stimulating introduction, the remainder of the book is somewhat disappointing to this reviewer. Much of it reads like an elaboration of the obvious. As an example, here is a description of the circulation of cities: "Pedestrian and animal movement, and most vehicular traffic are served by a grid of streets, mostly paved, which subdivide the city into many small blocks. Some of the streets are wide, others vary narrow; some serve rapid traffic, others permit only a slow stream of movement. A single system of underground pipes provides water. . . ." The large number of simple descriptions and definitions hardly seem in keeping with the philosophical introduction and the scholarly references of the book.

In total, the reviewer feels that Wagner has not succeeded in fulfilling his purpose. Although he has shown that there is an orderliness in the way different groups of people organize themselves and utilize techniques and tools, he has not developed any general propositions which will greatly assist geographers in understanding the

distribution of man-made features on the surface of the earth.

[RALPH R. KRUEGER]

Latin America: A Regional Geography, by GILBERT J. BUTLAND, Longmans, Green and Co. Ltd., London, 1960, 373 pp., maps.

IN CANADA, the gap between secondary school and university is a wide one, and books are normally written for one level or the other. Butland's volume on Latin America is designed for the British intermediate level, which bridges the gap between secondary school and university. This makes the task of evaluating this book for the Canadian educational system a difficult one.

Butland, in his introduction, points out that he aims at no higher an educational level than first year university. However, any author who presents a regional text on Latin America to the university community must lay himself open to a comparison of his work with that of Preston E. James. James' *Latin America* has been for many years and through three editions the standard university text on the area; further, it has served as a veritable model of what a regional text should be. Compared to James' *Latin America*, Butland's book lacks depth and detail. It clearly will not replace the work of James as the standard regional text on Latin America. However, as a high school text or as a text in teacher-training institutions it is excellent.

The pithy introductory chapter lays bare most of the fundamental aspects of the human geography of Latin America. The early establishment of most of the major cities, the historical basis of the present political pattern, the basis of the land-holding systems, and the various ethnic elements are introduced in this short but interesting chapter.

The treatment of the physical geography of Latin America in Chapter Two is so cursory as to be valueless. The author excuses the cavalier treatment of the physical scene on the grounds that many of the students in the British educational system will have covered the basic physical geography in previous courses. However, the lack of a more thorough treatment of the physical geography most certainly will affect the acceptance of the book outside the United Kingdom.

Over nine-tenths of the book is devoted to regional discussions. These are organized into five groups: Middle America, the North Andean Republics and the Guianas, the Pacific Republics, the Plata Republics, and Portuguese America. Within each of these groups a regional description of each state is offered.

Some might quarrel with a regional organization based upon political units; however, in Latin America, especially, this is preferable. Butland points out that the national individuality of the twenty Latin American republics is growing rather than diminishing, and it must be kept in mind that economic life is focussed on the capital city in Latin America to a degree matched by few other areas of the world.

With the description of Bolivia covering only seven pages and that of Ecuador comprising a mere eight pages, the regional discussions are obviously much too short for university students striving for a thorough understanding of the states of Latin America. It is admitted that the various short chapters on the individual political units are masterpieces of clarity, and most certainly touch upon most of the important aspects of each state, but detail and discussion would greatly add to their value. Of the chapters on the smaller republics, that of Chile is fuller than most and constitutes an excellent part of the book.

Each chapter on a state concludes with a statistical summary which is most useful. The various summaries include: population, percentage of land in various uses, number of livestock of various types, road and railway mileages, production of principal products, and principal exports by value.

Six pages of carefully chosen references, a glossary of Spanish and Portuguese geographical terms, and an index conclude the work. The maps are clearly drawn, and serve the text well.

This is an excellent first book on Latin America; it is exceptionally well-written, well-organized, and attractive. It should whet the appetite of the university student for further work on Latin America, and should give the general public and the high

school student a good working knowledge of this most important, and, in Canada, too frequently neglected area.

[F. B. WATTS]

Case Studies in World Geography: Occupance and Economy Types, by R. M. HIGHSMITH (editor), O. H. HEINTZELMAN, J. G. JENSEN, R. D. RUDD, and P. R. TSCHIRLEY, Prentice-Hall, Inc., Englewood Cliffs, N.J., 1961, 218 pp., maps and diagrams.

IT HAS BEEN TRADITIONAL for textbook presentation in human geography to proceed along one of two lines. The first sets out to look at the earth by means of various elements such as settlements and economic activities. These are studied separately but closely attached to environmental conditions, so that a wide range of man-land relationships can be presented. The second type of study is regional, and here large areas of the earth are considered and compared with one another. Each approach demands treatment that is both general and specific. Clearly, there is a need for the global or part-global brush to splash and blend together the many features that are part of human geography. This is what is attempted (not very successfully) in most textbooks. At the same time, specific examples drawn not with a brush but with a fine pen are needed to bring substance, or refutation, to the generalities. How to combine the two techniques is a problem that bedevils the textbook writers.

A simple solution to the difficulty is the assigning of a large number of specific studies to augment what is found in the textbooks. This, however, requires the student to seek out the library and entails inconvenience and annoyance. It is more practical, and perhaps safer, to try to put the specific studies in one book, to compress the library between two paper covers. This is what has been attempted by a group of geographers at Oregon State College in the volume, *Case Studies in World Geography*. They have put together a book of readings designed to accompany standard texts. "Its purpose," states the editor, "is to give the student detailed examples of world geography . . . which provide both world coverage and depth of analysis." It is to the authors' credit that they are not daunted by the lofty heights they have set out to scale.

The book contains twenty-nine studies, original with the five authors and grouped according to six major occupance and economy types: agriculture, biotic resources, minerals, recreation, manufacturing, and urban functions. The studies are very short, usually taking up only six or seven pages each. They are accompanied by maps and sketches, but these have been reduced to a minimum in order to reduce publication costs. Photographs have been omitted for the same reason. "This is justified," writes the editor, "by the belief that the book thereby can serve a wider range of students."

The most satisfactory studies are those dealing with agriculture. This group contains almost one-half of the readings, ranging in subject from shifting cultivation in western Nigeria to desert agriculture in the Qanat of Iran to fjord farming in Norway. It is no mere coincidence that the quality of a study seems to improve with its length. The longest in the book, dealing with changing land use in Natchitoches Parish, Louisiana, is one of the best, providing worth-while detail in both physical and human geography. In contrast, *Land Reclamation in the Netherlands* receives only five pages in a treatment reminiscent of a newspaper article. It is hard to reconcile this sort of superficiality with the stated objective of "depth of analysis." Most of the studies fail to rise above the general level of description and presentation of the "facts" of the area or the occupance type. They are summary reports and often emphasize the very dangers of determinism and parochialism that detailed studies are supposed to overcome. A reading of the study of the Pendleton area, Oregon, as an example of commercial crop farming in middle latitude semi-arid lands, leaves one with the impression that farming in this type of environment faces no serious problem. Here is the writer's conclusion:

> The farmers of the Pendleton area have adjusted well to the semiarid environment. Through experience they have learned that they need to work with nature. In doing so they have established the basis for both a permanent agriculture and a high standard of living.

Is this depth of analysis? In another study, a very competent (but short) description of the ejido in Mexico, this unique land tenure system is described as one whose "impact on the landscape and economy of Mexico is far reaching." But it is this very impact which receives the briefest consideration.

Some of the articles do succeed creditably in a few pages. An example is "Olive Culture in the Mediterranean Lands: The Hacienda de Córdoba," which manages to relate olive cultivation on a Spanish estate with that in the Mediterranean area both interestingly and effectively.

The remaining five sections of the book receive extremely uneven treatment and one wonders what the authors had in mind in their use of the term "world coverage." Particularly poorly served are occupancy and economy types based on manufacturing and urban functions. All the examples are drawn from North America. The urban section is represented by only two "cases," Vancouver, British Columbia, and Terre Haute, Indiana. The same weighting toward American and western examples is a characteristic of the whole book. Obviously, the scope of the studies can only be as wide as the experience of the authors. But it is a bit presumptuous to claim "world coverage" for what is presented here.

The book then provides neither world coverage nor depth of analysis. What it does provide is a large number of specific descriptions, some of which are interesting and most of which are useful. Certainly, the readings will add materially to what is found in general textbooks in human geography. They are no substitute, however, for the library.

[R. Louis Gentilcore]

An Introduction to Geography, by Rhoads Murphey, with maps by John Sherman, Rand McNally, Chicago, 1961, 700 pp.

An environmental determinist might say: "An introductory textbook in geography emanating from the University of Toronto would stress strongly description and analysis of the physical environment and the use of field traverses and block diagrams. One from the University of Washington, by contrast, would pay relatively little attention to these things, but concentrate on the human landscape, emphasizing economic interactions, and especially transportation. The regional geography would be very well done, and the cartography, of course, superb." Give this determinist Rhoads Murphey's new book, and you will hear him say: "The School of Washington, to the life!" And he will be right—but only partly. True, the physical aspects of geographic thought are held subordinate to the human; the concepts about spatial interaction formulated by Edward L. Ullman of Washington are given a prominent place; the pervasive role of transportation is exceptionally well handled; and the maps are indeed superb. But one whole side of the Washington school is dismissed in a few paragraphs, for some of the best work in quantitative geography has been done at Washington. Though the leader of the quantitative school, William L. Garrison, is no longer there, it is only a year since he left and his influence is still strong. Yet Murphey contents himself with the statement:

> It is clear that the students of society must depend upon more than quantitative methods, although quantitative analysis can be very helpful to him where it is appropriate. Geography especially, by its very nature incorporates an enormous field of study, encompassing, like history, most of human experience. The geographer must depend on a variety of methods in his analysis and cannot limit his investigations either to strictly quantitative measurements or to purely subjective or intuitive judgments. (pp. 6–7)

This is extremely well said, but is it *all* that should be said? Might it not be a good thing, in introducing students to geography, to introduce them at the same time to some of the heady controversies that rage so enjoyably among geographers?

There is an admirable discussion of prediction and causality (p. 7–9) that gently sets determinism aside. The student is led to the ways of right thinking, as Murphey (along with most of the rest of us) sees the right. It is good, calm exposition that avoids confusing the beginner. But how stimulating to the occasional disputatious youngster to be referred to some of the rambunctious arguments of Griffith Taylor, the deadly refutations of George Tatham,

O. H. K. Spate's "Probabilism," the new revival of determinism among young British geographers, and above all the definitive, if difficult, articles by the Sprouts. It speaks for the vitality of geography as a discipline that there are such controversies. And, if you do not happen to be too strongly attached to one side of any given question, it is also very good fun.

Are there no other criticisms to be made? Yes, fortunately, else how could one retain membership in the society of scholarly reviewers? Of 665 pages of letter-press, fully 498 are devoted to an examination of the countries of the earth; the remaining 167 pages seem scarcely enough to give a balanced introduction to the many other fascinating aspects of geography. And in the former section a similar lack of balance is apparent. Is it really enough to give twenty-five pages to the whole of what Murphey calls "Anglo-America: A Modern Prodigy," while devoting more than twice as many to "the dry world," which is restricted to the arid parts of Africa and Asia?

Nor are we Canadians likely to be altogether happy with the amount of attention that our country receives. Just to call Canada "Anglo-American" must give us pause, for of course much of it isn't. Murphey knows perfectly well that there is a French Canada, although he is perhaps a little old-fashioned in assessing its character. "The culture of French Canada," he says, "has from its inception been extremely conservative or even reactionary and has in many ways tended to preserve the culture of the *ancien regime* of seventeenth-century France" (p. 667). Not to explain the logic behind this determined retention of identity, nor to continue with an acknowledgement that French Canada is today experiencing cultural ferment that makes it "a modern prodigy" in its own right, demonstrates once more a certain lack of balance. Further, Canadians have long been unhappy over the dearth of information, or prevalence of misinformation, about this country in the United States. Where better than in an introductory book on geography to present some worth-while information about us to American students? And it would do no harm to these same students if they were told something about the changing relations between our two countries, particularly since they are living and studying in a period when those relations are experiencing unwonted stresses. The lack of awareness of the existence of these stresses, even among well-informed citizens of the United States—even among geographers! —is astonishing.

Now that I have found my quota of faults, let me return to the more congenial task of cataloguing the many virtues, some of which have already been mentioned. To begin with, I am pleased to see the emphasis that transportation receives. Much of this is probably attributable to the influence of Edward Ullman. Indeed, the whole underlying philosophy of the book can be traced to Ullman. To him geography is primarily the study of spatial interaction, and Murphey gives one of the best chapters in his book to this concept.

In view of the outstanding contributions he has made to the geographic study of China, it is not surprising that Murphey does very well by this country here. He devotes two chapters to it, "The Middle Kingdom: Splendid Isolation" and "Changes in the Good Earth" (note the judicious use of evocative terms that are thoroughly familiar to everyone and that immediately establish place, time, and process). Both here and in the chapter on Russia, where it is most difficult for an American author writing today to achieve balance (and where accordingly balance is most important), it is provided.

Now, for the furniture of the book. It is surprising, and regrettable, that in a book otherwise so well made the author should be so badly served in the reproduction of well-selected photographs. The maps, on the other hand, are a delight. They have the fine execution that one has come to expect from the Washington school. A series of nineteen world maps in colour have been inserted as a divider between the systematic and the regional sections of the book. Pleasant to look at though they are, they are on such a small scale that over-generalization is unavoidable; and perhaps Trewartha's modification of the Koeppen system was not the happiest choice for classifying the climates of the earth. No matter; the beginning student

will not be harmed by any of this, whereas he is sure to be beguiled by the over-all appearance of the maps.

Each chapter has appended to it a short, useful bibliography, and a list of well-thought questions that demand equally well-thought answers.

In order that pages not be broken up by masses of figures, all quantitative data about the countries of the world have been gathered in a statistical appendix. They are listed under more than thirty headings, and anything the student may reasonably be expected to learn about the populations of the world's metropolitan areas, the percentage of the cultivated area in each of the major crops (though unfortunately no data are given about the total area of each country), or the value of imports in American dollars, will be found there. The statistical appendix is reminiscent of the excellent tables in the *Encyclopaedia Britannica World Atlas*, upon which it has undoubtedly been modelled. Nothing in the book is better than the introduction to this appendix (p. 669), which says, in part, ". . . the printing of a figure, no matter how inaccurate the figure is, tends to imply that it is accurate and that the compiler has complete faith in it, or at least that the compiler knows without reservation what the quantitative truth of the matter is. This is rarely if ever true. The reader is warned to use the figures which follow with caution, disregarding the air of finality and precision which a printed figure tends to carry with it. . . ." Admirable; but the mere fact that the warning had to be made is evidence that it will be disregarded.

Finally, this book is outstanding where it most needs to be outstanding—in the style of writing. It is an intensely personal book, reminiscent of the wonderful geography texts by J. Russell Smith. The personality of the author—vivacious, gentle, easy, friendly, and altogether unpretentious—comes through undiluted.

[ROY I. WOLFE]

Understanding Weather, by O. G. SUTTON, Penguin Books Ltd., Harmondsworth, Middlesex, 1960, 215 pp.

THE AIM OF this volume is "to help toward a better understanding, not only of weather, but also of the way in which the meteorologist approaches his problems." In his typically lucid style, the author has succeeded admirably in achieving this aim of providing a comprehensive and fascinating account of the growth of meteorology.

The thread of continuity which the author follows takes as its point of departure a descriptive account of the atmosphere as determined by the many observational tools available to the meteorologist —balloons, sound waves, searchlights, meteors, rockets, and artificial earth satellites. Following this, comes a chapter entitled "The Atmospheric Engine," in which the role of water vapour in controlling heat energy and its distribution is discussed. This relatively minute but important atmospheric constituent, together with the radiation balance and the rotation of the earth, are shown to determine the large-scale features of the global winds, commonly referred to as the general circulation of the atmosphere.

Against the background of the radiative balance and the general circulation, the reader is led to view the "weather" processes of his world of experience—winds, clouds, rain, the violent but infrequent tornadoes and hurricanes, the jet streams of the upper troposphere, cloud physics, the formation of rain and snow, and finally rain-making. The other point of contact with everyday experience is effected by relating these features to the familiar pressure configurations on weather maps, so familiar to present-day television viewers.

Chapters 5, 6, and 7 concern the general problem of weather forecasting, the role of communications, the professional work of an analyst and prognostician, and the formulation of specific forecasts.

Modern numerical forecasting using high-speed electronic computers occupies the next chapter and here is described the magnificent pioneer effort of the British mathematician, L. F. Richardson, in the field of numerical weather prediction. Although his research was regarded as a failure at the time, he is now considered the father of numerical forecasting. In the words of Sir Graham Sutton, "Meteorology owes much to this extraordinary man who, true to the traditions of his sect, had the

courage to publish the truth to the world, ludicrous though the result may have seemed to the meteorologists of his time." The only mathematical part in the whole book appears in this chapter in connection with a clear and concise illustration of the modern process of numerical weather prediction.

Long-range forecasting is then reviewed and rightfully assessed as the most intractable problem in the whole of meteorology. To date, all efforts have led largely to failure. However, the author suggests that the greatest hope for a break-through in solving the long-range prediction problem lies in the use of high-speed computers employing dynamical methods.

Micrometeorology, in the last chapter, is the author's special field of interest. Here he describes the detailed study of the lowest layers of the atmosphere in which we spend our lives. The problems of atmospheric turbulence, diffusion, evaporation, and heat transfer lend themselves to the tools of the applied mathematician and it is in this field that meteorology has developed into a rigorous science.

In summary, this book on weather is most readable and fully merits the attention of scientists in related disciplines, who, I'm sure, will agree with the author that meteorology may indeed rank as the most fascinating and at the same time the most exasperating of all the earth sciences.

[ROY LEE]

Siberian Arctic: The Story of the Siberian Company, by JONAS LIED, Methuen & Co., London, 1961, 217 pp.

THE RISE and fall of the Siberian Company, a private trading firm, is fully described by its founder and managing director, Jonas Lied, in his recent book *Siberian Arctic*. This company attempted to conduct a profitable trade between Europe and western Siberia by utilizing the Arctic Ocean and the Ob and Yenisei rivers. In essence the board of directors of the Siberian Company was gambling that, in spite of the hazards of ice, the competition of railways, and the vacillations of the economic policy of the Tsarist government, the Arctic Sea route was a profitable trading route.

On January 5, 1912, the Siberian Steamship Manufacturing and Trading Company was formed in Oslo thanks largely to the initiative of Jonas Lied. During the late summer of the same year the firm chartered two ships. But the first year of operations ended in dismal failure mainly because of heavy ice conditions in the Barents and Kara seas. However, the following year cargoes were successfully delivered to Golchikha and back to the port of Immingham, England. A river craft was equally successful in transporting German cement to southern Siberia. Almost at once both Europeans and Russians recognized the commercial significance of the Kara Sea trade route. Consequently the volume of trade in the next few years increased greatly.

In the war years of 1914 and 1915 the company profitably transported goods to and from Russia and Britain. At the end of 1915, all the company's debts were cleared and its prospects seemed limitless. As a result, the firm expanded its operations by purchasing ships and property and established some small industries in western Siberia. The company expected to establish a huge trading empire with extensive holdings in western Siberia. However, this promising but embryonic trading empire soon died in the chilled economic atmosphere of the Bolsheviks. Lenin had no hesitation in confiscating the Russian assets of the Siberian Company and rejecting the company's pleas for negotiation. Thus after five difficult years of pioneering effort, the company was effectively bankrupt in 1917. The plans and dreams of Jonas Lied for an international Arctic Sea trade route had collapsed ignominiously.

The Kara Sea route under the Soviets is also described by Mr. Lied. Unfortunately much of the material on Soviet shipping activities lacks the depth which the earlier chapters displayed. Indeed the section dealing with the post-1945 period consists of only nine pages of sketchy material. Nevertheless this informative account of the Siberian Company by its chief architect is a popular but valuable story of arctic commercial shipping under free enterprise —the forerunner of the Soviet's Northern Sea Route operations.

[ROBERT M. BONE]